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Japanese Kokai Patent Application
No. Hei 10[1998]-194388

ARTICLE HOLDER

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ARTICLE HOLDER

[Butsuhin hojigu]

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[There are no amendments to this patent.]

Claims

1. A type of article holder characterized by the following facts: the article holder has an article holding member, and it can hold an article by means of said article holding member; this article holding member is made of a shape-memory material; the shape-memory member can be deformed to an article holding shape that fits the desired article shape at a temperature higher

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* [Numbers in right margin indicate pagination of the original text.]

than a prescribed temperature, and it can be fixed in said article holding shape in the application temperature range lower than a prescribed temperature so as to form an article holding region.

2. A type of article holder characterized by the following facts: the article holder has an article holding member that can hold articles; for this article holder, the article holding member is made of a shape-memory material; the article holding member memorizes a first article holding shape, which fits the first article shape, as an initial memory shape and forms a first article holding region, and then the shape-memory member can be deformed to a second article holding shape, which fits a second article holding shape, at a temperature higher than a prescribed temperature; in the application temperature region lower than a prescribed temperature, and the second article holding shape is fixed to form a second article holding region.

3. The article holder described in Claim 1 or 2 characterized by the fact that said shape-memory member is made of a shape-memory resin.

4. The article holder described in Claim 1 or 2 characterized by the fact that said shape-memory member is a composite made of a shape-memory resin and a shape-memory alloy.

5. The orifice hole described in any of Claims 1-4 characterized by the fact that said article holding member is composed of plural shape-memory members, and the shape-memory members are set around the article holding region in radiating shape.

6. The article holder described in Claim 5 characterized by the fact that the tip portion of said shape-memory member facing the article holding region has a flat plate shape.

7. The article holder described in any of Claims 1-6 characterized by the fact that said article holding member is set on a base member, and a height adjusting member is included between said base member and the article holding member.

Detailed explanation of the invention

[0001]

Technical field of this invention

This invention pertains to a type of article holder appropriate for holding containers and other articles in container treatment operations or the like, including filling and capping.

[0002]

Prior art

In the prior art, article holders are described in Japanese Kokai Patent Application Nos. Hei 4[1992]-154550 (prior art 1) and Hei 4[1992]-279497 (prior art 2).

[0003]

In prior art 1, an article holding member is set on a base member, and the article holding member can hold the article. The article holding member is composed of plural holding pieces made of an elastic sheet material. The holding pieces are made of an elastic sheet material, and they can fit various articles in different shapes.

[0004]

In prior art 2, an article holding member made of V-shaped fingers is set on a base member. The V-shaped fingers are positioned at prescribed positions corresponding to the article as the object for holding by means of a servo motor. As a result, various articles in different shapes can be handled.

[0005]

Problems to be solved by the invention

The aforementioned prior arts have the following disadvantages.

① In prior art 1, the range of dimensions of the shapes of articles that can be held within the elastic deformation range of the elastic sheet material is small. Consequently, depending on the shape of the article, variation in the elastic holding force of the elastic sheet material applied on the article takes place; and stable holding may not be possible. Consequently, there is a substantial limit on the shape of the articles that can be held.

[0006]

② In prior art 2, as control is performed on the positions of the V-shaped fingers, the mechanical and electrical structures are very complicated. Also, the shape of the V-shaped surface of the V-shaped fingers is fixed, so that the shape of the articles that can be held is limited.

[0007]

The purpose of this invention is to provide a type of article holder that has a simple structure and can hold articles in various shapes in a stable way.

[0008]

Means to solve the problem

The invention described in Claim 1 pertains to a type of article holder characterized by the following facts: the article holder has an article holding member, and it can hold articles by means of said article holding member; this article holding member is made of a shape-memory

material; the shape-memory member can be deformed to an article holding shape that fits the desired article shape at a temperature higher than a prescribed temperature, and it can be fixed in said article holding shape in the application temperature range lower than a prescribed temperature so as to form an article holding region.

[0009]

The invention described in Claim 2 pertains to a type of article holder characterized by the following facts: the article holder has an article holding member, that can hold articles; for this article holder, the article holding member is made of a shape-memory material; the article holding member memorizes a first article holding shape, which fits the first article shape, as an initial memory shape and forms a first article holding region, and the shape-memory member can be deformed to a second article holding shape, which fits a second article holding shape, at a temperature higher than a prescribed temperature; in the application temperature region lower than a prescribed temperature, and the second article holding shape is fixed to form a second article holding region.

[0010]

The invention described in Claim 3 pertains to the article holder described in Claim 1 or 2 characterized by the fact that said shape-memory member is made of a shape-memory resin.

[0011]

The invention described in Claim 4 pertains to the article holder described in Claim 1 or 2 characterized by the fact that said shape-memory member is a composite made of a shape-memory resin and a shape-memory alloy.

[0012]

The invention described in Claim 5 pertains to the orifice hole described in any of Claims 1-4 characterized by the fact that said article holding member is composed of plural shape-memory members, and the shape-memory members are set around the article holding region in radiating shape.

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[0013]

The invention described in Claim 6 pertains to the article holder described in Claim 5 characterized by the fact that the tip portion of said shape-memory member facing the article holding region has a flat plate shape.

[0014]

The invention described in Claim 7 pertains to the article holder described in any of Claims 1-6 characterized by the fact that said article holding member is set on a base member, and a height adjusting member is included between said base member and the article holding member.

[0015]

According to the invention described in Claim 1, the following function ① can be realized.

① The shape-memory member that forms the article holding member can be changed to various article holding shapes corresponding to the desired shapes of articles (hereinafter to be referred to as article models), and these article holding shapes can be fixed. That is, with a simple structure in which the article holding member is made of a shape-memory member, it is possible to form various article holding regions, and it is possible to hold articles of various shapes in a stable manner.

[0016]

In this case, as the shape-memory member, one may make use of a shape-memory resin and a shape-memory alloy. Both types can recover the initial memory shape (such as a flat shape) when heated to over a prescribed temperature, and they can be deformed to the article holding shape that fits the article. Then, as both are cooled to a temperature region of use lower than a prescribed temperature, they are fixed to the aforementioned article holding shape so as to form an article holding region.

[0017]

The invention described in Claim 2 has the following function ②.

② The shape-memory member that forms the article holding member has the first article holding shape imparted to it as the initial memory shape. Also, it can be deformed to various second article holding shapes corresponding to the various desired article shapes, and it can be fixed in the second article holding shape. That is, with a simple structure of the article holding member made of a shape-memory member, a first article holding shape as the initial memory shape and the second holding shape obtained by deformation of said first article holding shape can be formed, and it is possible to hold articles in various shapes in a stable manner.

[0018]

After the first article holding shape of the article holding member is imparted as the initial memory shape, when the member is set at a temperature higher than a prescribed temperature (glass transition point T_g), it recovers to the first article holding shape as the initial memory shape. As it is cooled down to an application temperature region (room temperature) lower than a prescribed temperature (glass transition point T_g) while the shape is maintained, the first article holding shape is fixed to form a first article holding region. Consequently, once the article shape with a high frequency of use among the various article holding shapes is memorized as the initial memory shape, as the article holding member of another article holding shape (the second article holding shape) is heated to above a prescribed temperature, the aforementioned first article holding shape can be obtained. As a result, it is possible to reduce the shape change frequency of the article holding member.

[0019]

In this case, one may make use of a shape-memory resin and a shape-memory alloy for forming shape-memory member. When they are both heated to over a prescribed temperature, they recover the initial memory shape (first article holding shape), and they can be deformed at will to another article holding shape (second article holding shape) that fits the prescribed selected article model. When both are cooled down to the application temperature region lower than a prescribed temperature, the aforementioned article holding shapes (first and second article holding shapes) are fixed to form article holding regions (first and second article holding regions).

[0020]

For Claim 3 of the invention, following function ③ can be realized.

③ In said ① and ②, for the shape-memory member fixed at the article holding shape in the application temperature region, when there is little difference between the thickness of the shape-memory alloy and that of the shape-memory resin, the modulus of the shape-memory resin is higher than that of the shape-memory alloy. Consequently, when a shape-memory resin is used as the shape-memory member, the modulus in the application temperature region is high, the material is hard, and it has a high article holding force so that the holding ability can be improved.

[0021]

The invention described in Claim 4 has the following function ④.

④ In said ① and ②, as the pre-operation for imparting a new article holding shape (shape change), the shape-memory member is heated to above a prescribed temperature, and it returns to the initial memory shape. In this case, the recovering force of the shape-memory alloy is higher than that of the shape-memory resin. Consequently, when a composite of the shape-memory resin and the shape-memory alloy is used for the shape-memory member, in the shape change operation of the shape-memory member, it can quickly recover the initial memory shape, and shape change can be performed quickly.

[0022]

The invention described in Claim 5 has the following function ⑤.

⑤ Plural shape-memory members that form the article holding member are set around the article holding region in radiating shape, so that the entire circumference of the article can be held with a high stability by the plural shape-memory members.

[0023]

The invention described in Claim 6 has the following function ⑥.

⑥ The tip portion of the shape-memory member facing the article holding region has a flat plate shape, so that the shape-memory member is in contact with the article with the surface of the flat plate (instead of dot or line), and the article can be held with a high stability.

[0024]

The invention described in Claim 7 has the following function ⑦.

⑦ By including a height adjusting member between the base member and the article holding member, the height of the position for holding the article where the article holding member is in contact with the article can be selected corresponding to the height of the article or other shape so that the article can be held more stably.

[0025]

Embodiment of the invention

Figure 1 is a schematic diagram illustrating the article holder in the first embodiment. Figure 2 is a schematic diagram illustrating the article holding member. Figure 3 is a schematic diagram illustrating another example of the article holding member. Figure 4 is a schematic diagram illustrating the article holding state. Figure 5 is an oblique view illustrating the article holder. Figure 6 is an oblique view illustrating the exploded state of the article holder.

Figure 7 is a schematic diagram illustrating a modified example of the article holding member. Figure 8 is a schematic diagram illustrating a modified example of the article holder. Figure 9 is a schematic diagram illustrating the shape change line of the article holder. Figure 10 is a schematic diagram illustrating the shape imparting device. Figure 11 is a schematic diagram illustrating the article holder in the second embodiment. Figure 12 is a schematic diagram illustrating the article holding state. Figure 13 is a schematic diagram illustrating the shape imparting device. Figure 14 is a schematic diagram illustrating the article holder in the third embodiment. Figure 15 is a schematic diagram illustrating the article holding state. Figure 16 is a schematic diagram illustrating the article holder in the fourth embodiment. Figure 18 is a schematic diagram illustrating a modified example of the article holder.

[0026]

First embodiment (Figures 1-10)

(Article holder (10)) (Figures 1-6)

As shown in Figures 1 and 4-6, for article holder (10), article holding member (14) is set via height adjusting member (13) on first and second base members (11), (12) as the base member, and article (1) (such as a container) can be held by said article holding member (14). For example, on a container treatment line including filling and capping operations, by means of article holder (10), articles (1) are transported by a conveyer, and each article (1) is positioned at the filling position of the filling machine and the capping operation position of the capping device, etc.

[0027]

First base member (11) has a rectangular shape. On its upper surface, a circular recess (11A) for fitting of second base member (12) is formed. On the lower surface, ridge portion (11B) for engagement to the engagement portion for feeding of the conveyer is formed, and through hole (11C) for cleaning is formed at the center. Also, positioning pins (11D) for second base member (12) are set at four positions P_1 - P_4 (corner points P_1 - P_4 of a rectangular shape) around the central shaft on the bottom surface of circular recess (11A).

[0028]

Said second base member (12) has a circular shape. It is composed of circular protrusion (12A) fitting to circular recess (11A) of base member (11) and annular portion (12B) on circular protrusion (12A). Also, lower peripheral side corner surface portion (12a) of circular protrusion (12A) of second base member (12) has a tapered shape, and it is easy to introduce it to circular recess (11A) of first base member (11). Also, positioning holes (12C) for engagement to

positioning pins (11D) of first base member (11) are set at four positions P_1 - P_4 on the lower end surface of circular protrusion (12A) around the central axis. Positioning pins (12D) for height adjusting member (13) are set at four positions R_1 - R_4 (corner points R_1 - R_4 of a rectangular shape) on the upper end surface of annular portion (12) around the central axis. Also, the upper end surface of annular portion (12B) is bonded with thin-suction sheet ring (15) made of magnet, metal sheet, or other magnetic material by means of an adhesive. Thin-sheet ring (15) has hole (15A) for insertion of positioning pins (12D) of annular portion (12B).

[0029]

Height adjusting member (13) is annular. At four positions R_1 - R_4 on the lower end surface around the central axis, positioning holes (13A) for engagement of positioning pins (12D) of second base member (12) are formed, respectively. At four positions R_1 - R_4 on the upper end surface around the central axis, positioning pins (13B) for positioning article holding member (14) are set, respectively. Positioning holes (13A) may be formed as tapered opening holes for facilitating positioning pins (12D) (Figure 1). Also, on the lower end surface of height adjusting member (13), thin suction sheet ring (16) made of magnet, metal sheet, or other magnetic material is bonded by an adhesive or the like. Thin-sheet ring (16) has holes (16A) in agreement with positioning holes (13A) of height adjusting member (13). Also, on the upper end surface of height adjusting member (13), thin-sheet ring (15) of the same type formed on the upper end surface of annular portion (12) of second base member (12) is joined.

[0030]

Article holding member (14) has an annular shape. At four positions R_1 - R_4 on the lower end surface around the central axis, positioning holes (14A) for engagement of positioning pins (13B) of height adjusting member (13) are formed, respectively. On the upper end surface, plural (six in this embodiment) shape-memory members (18) fixed by fixing ring (17) are formed horizontally. Fixing ring (17) is mounted on the upper end surface of shape holding member (14) by means of screw (17A). Also, on the lower end surface of shape holding member (14), thin-sheet ring (16) of the same type as that formed on the lower end surface of height adjusting member (13) is joined.

[0031]

As shown in Figure 2, article holding member (14) is composed of six shape-memory members (18), with said shape-memory members (18) set in radiating shape around the central axis. By means of their tip portions, article holding region (19) (Figures 5 and 6) is formed. In this case, said shape-memory members (18) are formed by processing a shape-memory resin

(such as shape-memory polymer “DIALLY” [transliteration] manufactured by Mitsubishi Heavy Industries, Ltd.) into a flat plate shape. As shown in Figure 2, the base end portion side fixed by means of fixing ring (17) is taken as fan-shaped portion (18A), and the tip portion facing article holding region (19) is formed as flat plate rectangular portion (18B).

[0032]

As shape-memory member (18) is made of shape-memory resin as explained in the above, the following effects can be realized: (a) At a temperature over a prescribed temperature (glass transition point T_g), it recovers the initial memory shape (such as a flat plate shape), and it can be deformed at will to the article holding shape fitting the article model. (b) In the application temperature region (room temperature) lower than a prescribed temperature (glass transition point T_g), said article holding shape is fixed, and article holding region (19) is formed. Shape-memory member (18) shown in Figures 1 and 2 has a flat plate-shaped initial memory shape, and shape-memory member (18) shown in Figures 4 and 5 has the article holding shape for holding a container with a fixed elliptical lateral cross-sectional shape.

[0033]

Consequently, for article holder (10), as the article holding shape is formed on shape-memory member (18) of article holding member (14) using an article having the same shape as that of the holding object article (the desired article shape) as described in said (a), (b), even when there is relatively small portion of shape-memory member (18) on the periphery of article holding region (19), flat plate-shaped rectangular portion (18B) can realize the article holding shape that is deformed to the curved shape shown in Figure 4, and the outer shape of article (1) can be held in a stable manner.

In this case, in the application temperature region where shape-memory member (18) made of a shape-memory resin is fixed, a high modulus is displayed. Consequently, in the application temperature region, it is hard, and a high article holding force can be realized.

[0034]

Also, when the article holding shape is imparted to shape-memory member (18), if the size of the article model is smaller than that of the holding object article, the article holding force of article holding region (19) is high, and, if the article model has a size larger than that of the holding object article, the article can be inserted smoothly into article holding region (19).

[0035]

Also, for article holding member (14), six shape-memory members (18) are set in a radiating shape around article holding region (19). Consequently, the entire circumference of article (1) can be held stably by said six shape-memory members (18). Also, for article holding member (14), if the lateral cross-section of holding object article (1) has an elliptical shape, the major axis direction of the elliptical shape is set in agreement with the distribution of the central line of a pair of shape-memory members (18), (18) positioned on the same diameter in article holding member (14), and the side surface in the major axis direction of the elliptic shape can be held stably at the central portion in the width direction of said shape-memory members (18).

[0036]

Also, for article holding member (14), the article holding shape is imparted to shape-memory member (18), and the tip portion that faces article holding region (19) forms flat plate rectangular portion (18B). Consequently, flat plate rectangular portion (18B) of shape-memory member (18) is in contact with the flat plate surface, and article (1) can be held stably.

[0037]

For article holding member (14), in the initial memory shape of shape-memory member (18) shown in Figure 2, there is overlap at the central portion of flat plate-shaped rectangular portions (18B) of all of shape-memory members (18). As a result, even when the size of the holding object article has the minimum diameter, shape-memory members (18) on the periphery of article holding region (19) have flat plate-shaped rectangular portions (18B) deformed to create the article holding shape, and article holding region (19) for the article with the minimum diameter can be formed reliably. That is, even articles (1) with the minimum diameter can be handled well.

[0038]

Also, for article holding member (14), in the initial memory shape of shape-memory members (18) shown in Figure 2, gap g is present between the adjacent shape-memory members (18) for all shape-memory members (18). As a result, when all of the shape-memory members (18) recover the flat initial memory shape as in said (a), and when they are deformed to the article holding shape by means of the article model, for the deformation for imparting the shape, there is no disturbance due to mutual scraping and interference between edges of adjacent shape-memory members (18). Consequently, shape-memory members (18) (especially flat plate-shaped rectangular portions (18B)) with the article holding shape imparted to them form a

straight article holding surface free of inclination or distortion around the central axis, and article (1) can be held with a high stability.

[0039]

In the following, the procedure for assembly of article holder (10) will be explained (Figure 6).

(1) Positioning pins (11D) formed at circular recess (11A) of first base member (11) are engaged in positioning holes (12C) formed on circular protrusion (12A) of second base member (12), and second base member (12) is fit in first base member (11).

[0040]

(2) Positioning pins (12D) set on annular portion (12B) of second base member (12) are engaged in positioning holes (13A) of height adjusting member (13). At the same time, thin-sheet ring (16) formed on height adjusting member (13) is adhered by magnetic force to thin-sheet ring (15) set on the upper end surface of annular portion (12B) of second base member (12). In this case, at least one of thin-sheet ring (15) and thin-sheet ring (16) may be made of a magnetic [material].

[0041]

(3) Positioning holes (14A) of article holding member (14) are engaged to positioning pins (13B) of height adjusting member (13). At the same time, thin-sheet ring (16) formed on article holding member (14) is adhered magnetically to thin-sheet ring (15) formed on the upper end surface of height adjusting member (13). In this case, at least one of thin-sheet ring (15) and thin-sheet ring (16) may be made of a magnetic [material].

[0042]

As a result of assembly of article holder (10) described in (1)-(3) above, when the cross-section of holding object article (1) has an elliptical shape as aforementioned, the major axis direction of elliptical article (1) is set in agreement with the distribution of the central line of the pair of shape-memory members (18), (18) positioned on the same diameter in article holding member (14), and the major axis direction of elliptical article (1) is in agreement with the transporting direction of article holder (10) by the conveyer, as the four members of first and second base members (11), (12), height adjusting member (13), and article holding member (14) are engaged to each other. The transporting direction of article holder (10) by the conveyer is orthogonal to ridge portion (11B) on the lower surface of first base member (11). Consequently, with respect to this direction of first base member (11), one can make appropriate selection for

[the positions] of positioning pins (11D) set on circular recess (11A) of first base member (11), the position of the rectangular shape composed of four positions P_1 - P_4 for positioning holes (12C) set on circular protrusion (12A) of second base member (12), positioning pins (12D) formed on annular portion (12B) of second base member (12), positioning holes (13A) set on height adjusting member (13), positioning pins (13B), and the position of the rectangular shape composed of four positions R_1 - R_4 of positioning holes (14A) set on article holding member (14). As a result, by assembling the four members, that is, first and second base members (11), (12), height adjusting member (13) and article holding member (14), the major axis direction of elliptical article (1) is in agreement with the central line of the pair of shape-memory members (18), (18) positioned on the same diameter in article holding member (14), and the major axis direction of elliptical article (1) is in agreement with the transporting direction of article holding member (10) by the conveyer. This assembly result can be realized in a natural way (free of errors in assembly when performed manually). As a result of this assembly operation, as explained above, by means of a pair of shape-memory members (18), (18) positioned on the same diameter in article holding member (14), the side of elliptical article (1) in the major axis direction is maintained in a stable way at the central portion of the width direction of the shape-memory members, and the transporting position can be guaranteed with the front side portion sandwiched between the two sides in the major axis direction of elliptical article (1) facing the side of the conveyer.

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[0043]

Also, for article holder (10), first base member (11) and second base member (12) are separated from each other, and circular protrusion (12A) of second base member (12) is fit in circular recess (11A) of first base member (11). Consequently, when circular protrusion (12A) of second base member (12) is rotated by 90° with respect to circular recess (11A) of first base member (11), and positioning pins (11D) are inserted in positioning holes (12C), it is possible to change the direction of the transporting posture of article (1) with respect to the transporting direction of the conveyer determined by ridge portion (11B) of first base member (11) (for example, setting the broad front side portion of elliptical article (1) to face the side or front side of the conveyer).

[0044]

Also, for article holder (10), by setting ridge portion (11B) in the rectangular shape of first base member (11) such that the major axis direction of the base member is along the conveyer transporting direction, it is possible to easily specify the direction of transportation of

article (1). However, when the direction of transportation of article (1) is of no concern, first base member (11) may be formed in circular shape or other shape instead of said rectangular shape.

[0045]

(Article holding member (20)) (Figure 3)

Article holding member (20) shown in Figure 3 differs from said article holding member (14) in that shape-memory member (21) that forms article holding member (20) is a composite of shape-memory resin (22) and shape-memory alloy (23). As far as the feature that fixing on article holding member (20) is performed by means of fixing ring (17) and screw (17A) is concerned, it is the same as article holding member (14).

[0046]

Just as shape-memory member (18) in article holding member (14), shape-memory resin (22) may also be shape-memory polymer "DIALLY" [transliteration], a product of Mitsubishi Heavy Industries, Ltd., and [each member] has fan-shaped portion (22A) and flat plate-shaped rectangular portion (22B). Shape-memory alloy (23) is formed in a rectangular shape attached on the central line on the inner surface of shape-memory resin (22). For example, it may be Ni-Ti alloy "K10K ALLOY" manufactured by Daido Special Steel Co., Ltd.

[0047]

Because shape-memory member (21) is composed of shape-memory resin (22) and shape-memory alloy (23), the following effects can be realized: (a) At a temperature over a prescribed temperature (glass transition point T_g , or shape recovery temperature A_f), as shape-memory alloy (23) has a modulus higher than that of shape-memory resin (22), with the aid of shape-memory alloy (23), shape-memory resin (22) can quickly recover the initial memory shape (such as a flat plate shape), and it can be deformed at will to the article holding shape fitting the article. (b) In the application temperature region (room temperature) lower than a prescribed temperature (glass transition point T_g , or shape recovery temperature A_f), said article holding shape is fixed, and article holding region (19) is formed.

[0048]

In this case, in the application temperature region where the article holding shape is fixed, shape-memory resin (22) of shape-memory member (21) has a high modulus, and this in the application temperature region, a high article holding force can be realized. Also, in the preoperation for imparting a new article holding shape (shape change) by heating shape-memory member (21) to a certain temperature to recover the initial memory shape, shape-memory alloy

(23) of shape-memory member (21) has a high recovering force. Consequently, the high recovering force influences shape-memory resin (23) with a lower recovering force by itself, so that the entirety of shape-memory member (21) quickly recovers the initial memory shape, and shape change can be realized in a short time.

[0049]

(Article holding members (30), (40)) (Figures 7(A), (B))

Article holding member (30) shown in Figure 7(A) differs from said article holding member (14) in that it is composed of four shape-memory members (31A)-(31D).

[0050]

Article holding member (40) shown in Figure 7(B) differs from said article holding member (14) in that it is composed of 12 shape-memory members (41A)-(41L).

[0051]

(Article holder (50)) (Figure 8)

Article holder (50) shown in Figure 8 differs from said article holder (10) in that second base member (12) is joined on first base member (11); height adjusting member (13) is joined on second base member (12); and article holding member (14) is joined on height adjusting member (13) (these features are the same as those of article holder (10)). Also, height adjusting member (13) is joined on article holding member (14), and article holding member (14) is joined on height adjusting member (13). In this way, for article holder (50), article holding members (14) are set at two positions in the height direction, so that long article (1) can be held stably.

[0052]

Also, as height adjusting member (13) can be joined on intermediate article holding member (14), positioning pin (52) is set in hole (51) formed on screw (17A) positioned on the upper end surface of article holding member (14), and positioning pin (52) of article holding member (14) can be engaged to positioning hole (13A) on the lower end surface of height adjusting member (13). Also, fixing ring (17) positioned on the upper end surface of article holding member (14) may be made of magnet, metal, or other magnetic material. Said fixing ring (17) has thin-sheet ring (16) of height adjusting member (13) adhered to it magnetically.

[0053]

(Method and device for shape change of article holder (10)) (Figures 9, 10)

As shown in Figure 9, shape change device (60) of article holder (10) (same for article holder (50)), is composed of article holding member feeding device (61), heater (62), shape imparting device (63), cooler (64), height adjusting member feeding device (65), and article holding member setting device (66).

[0054]

Article holding member feeding device (61) is made of a robot. Article holding member (14) of article holder (10) carried from article holder carry-in line (71) is taken out from first and second base members (11), (12), and it is transferred to chuck (72A) of article holding member molding line (72). Then, said article holding member (14) is fed to heater (62).

[0055]

Heater (62) heats shape holding member (18) of article holding member (14) to over a prescribed temperature so that it recovers the initial flat memory shape. More specifically, heater (62) may be an IR heater or the like.

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[0056]

Shape imparting device (63) heats shape-memory member (18) to over a prescribed temperature to fit an article model so as to deform it to the article holding shape. More specifically, as shown in Figure 10, shape imparting device (63) may be composed of a pair of molding parts (63A), (63B) that sandwich shape-memory member (18) from the outer and inner sides, respectively. The outer surface of upper molding part (63A) (male mold) has a shape in agreement with the outer shape of the article model, while the inner surface of lower molding part (63B) (female mold) is similar to the outer shape of the article model, but larger by an amount corresponding to the sheet thickness of shape-memory member (18).

[0057]

Cooler (64) cools shape-memory member (18) with said article holding shaped imparted on it by said shape imparting device (63) to over a prescribed temperature so as to fix said article holding shape. More specifically, shape imparting device (63) includes a refrigerant contained in molding parts (63A), (63B) of shape imparting device (63).

[0058]

Height adjusting member feeding device (65) is made of a robot, it has height adjusting member (13) joined to first base member (11) and second base member (12) carried in from article holder carry-in line (71) to bypass line (73).

[0059]

Article holding member setting device (66) is a robot device. It sets article holding member (14), which has a new article holding shape by said heater (62), shape imparting device (63) and cooler (64) on article holding member molding line (72), on first base member (11) and second base member (12) exhausted from bypass line (73), and height adjusting member (13). In this way, assembly of new article holder (10) is finished. Said article holder (10) is carried out by article holder carry-out line (74) to the next step of operation.

[0060]

Consequently, by means of shape change device (60), article holder (10) performs the following shape change operation.

(1) Article holder (14) is fetched by article holding member feeding device (61) from first base member (11) and second base member (12), and article holding member (14) is fed to heater (62).

[0061]

(2) By means of heater (62), shape-memory member (18) of article holder (14) is heated to over a prescribed temperature to recover the initial flat memory shape.

[0062]

(3) Shape-memory member (18) that has been heated to over a prescribed temperature is deformed to the article holding shape by means of shape imparting device (63).

[0063]

(4) By means of cooler (64), shape-memory member (18) is cooled to lower than a prescribed temperature so as to fix said article holding shape.

[0064]

(5) As needed, by means of height adjusting member feeding device (65), first base member (11) and second base member (12) are joined to height adjusting member (13).

[0065]

(6) By means of article holding member setting device (66), article holding member (14) in said step (4) is set on first base member (11) and second base member (12) as well as height adjusting member (13) in said step (5).

[0066]

For shape change device (60), by manipulating article holding member feeding device (61), heater (62), shape imparting device (63), cooler (64), height adjusting member feeding device (65), article holding member setting device (66), article holder carry-in line (71), article holding member molding line (72), bypass line (73), and article holder carry-out line (74), among first base member (11) and second base member (12) that form article holder (10), as well as height adjusting members (13) and shape holding members (14), one can make appropriate changes for the number and installing positions of height adjusting members (13) as well as the number and setting positions of article holding members (14), so that it is possible to make assembly at will for the long type having plural height adjusting members (13), the multi-stage type having plural article holding members (14) set at appropriate heights, respectively, etc.

[0067]

Consequently, in this embodiment, the following functions can be realized.

(For article holder (10))

① It is possible to deform shape-memory member (18) that forms article holding member (14) to various article holding shapes, and to fix at each article holding shape. That is, by means of a simple structure in which article holding member (14) is made of only shape-memory member (18), it is possible to form various article holding regions (19) so as to hold articles in various shapes stably.

[0068]

In this case, shape-memory member (18) may be made of a shape-memory resin and a shape-memory alloy. Both types can recover the initial memory shape (such as a flat shape) when heated to over a prescribed temperature, and they can be deformed to the article holding shape that fits the article model. Then, as both are cooled to a temperature region of use lower than a prescribed temperature, they are fixed to the aforementioned article holding shape so as to form article holding region (19).

[0069]

② In said [1], for shape-memory member (18) fixed at the article holding shape in the application temperature region, the modulus of the shape-memory resin is higher than that of the shape-memory alloy. Consequently, when a shape-memory resin is used as the shape-memory member (18), the modulus in the application temperature region is high, the material is hard, and it has a high article holding force so that the holding ability can be improved.

[0070]

③ In said ①, as the pre-operation for imparting a new article holding shape (shape change), shape-memory member (21) is heated to above a prescribed temperature, the shape recovers the initial memory shape. In this case, the recovering force of shape-memory alloy (23) is higher than that of shape-memory resin (22). Consequently, when a composite of shape-memory resin (22) and shape-memory alloy (23) is used as shape-memory member (21), in the shape change operation of shape-memory member (21), it can quickly recover the initial memory shape, and shape change can be performed quickly.

[0071]

④ Plural shape-memory members (18) that form article holding member (14) are set around the article holding region in a radiating shape, so that the entire circumference of the article can be held at a high stability by plural shape-memory members (18).

[0072]

⑤ The portion of shape-memory member (18) facing article holding region (19) is flat plate-shaped rectangular portion (18B), so that shape-memory member (18) is in contact with the article with the surface of the flat plate (instead of dot or line), and the article can be held at a high stability.

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[0073]

⑥ By including height adjusting member (13) between base members (11), (12) and article holding member (14), the height of the position for holding the article where article holding member (14) is in contact with the article can be selected corresponding to the height of the article or other shape so that the article can be held more stably.

[0074]

(For the method and device for shape change of article holder (10))

① For shape-memory member (18) that forms article holding member (14), by performing heating, shape imparting and cooling, a new article holding shape can be imparted and fixed for said shape-memory member (18) (shape change). That is, in the shape change operation, there is no need to exchange article holding member (14). Instead, one may just change the shape of shape-memory member (18). The operation is thus simpler, and it facilitates automation.

[0075]

② Before performing said heating operation in said [1], shape-memory member (18) that forms article holding member (14) is taken out from base members (11), (12). After said cooling operation in [1], article holding member (14) is set in the base members. Consequently, it is easy to perform various operations of heating, shape imparting and cooling for shape-memory member (18), and the operations can be performed at a high efficiency. That is, article holding member (14) is cut off from the base members and it is an independent member. Consequently, the thermal capacity is small in the heating and cooling operation, so that it is possible to increase the heating efficiency and cooling efficiency. Also, as shape-memory member (18) is not shielded by the base members for its lower side, the molding parts can work easily from both inner and outer surfaces of shape-memory member (18), and the operability of the shape imparting operation can be improved.

[0076]

③ Shape imparting device (63) is composed of a pair of molding parts (63A) and (63B) that sandwich shape-memory member (18) from the outer and inner sides, respectively. As a result, shape-memory member (18) can impart the article holding shape reliably and quickly.

[0077]

(Second embodiment) (Figures 11-13)

(Article holder (80)) (Figures 11, 12)

For article holder (80), hexagonal frame (83) is supported via columns (82) on rectangular base member (81), and six shape-memory members (85) that form article holding member (84) are hanging down and supported on the edges of frame (83).

[0078]

Shape-memory member (85) is composed of the same type of shape-memory resin as that for shape-memory member (18) in the first embodiment. As a result, for shape-memory member (85), (a) at a temperature over a prescribed temperature (glass transition point T_g), it can recover the initial memory shape (such as a flat plate shape), and it can be deformed at will to the article holding shape fitting the article model. Then, (b) in the application temperature region (room temperature) lower than a prescribed temperature (glass transition point T_g), said article holding shape is fixed, and article holding region (86) is formed.

[0079]

(Method and device for shape change of article holder (80)) (Figure 13)

Just as shape change device (60) in the first embodiment, shape change device (90) of article holder (80) is also composed of a heater, a shape imparting device, and a cooler. As shape imparting device (91), balloon (91A) (such as "AIRPICKER" [transliteration] manufactured by Bridgestone Corp.) is used as shape imparting device (91). That is, for shape imparting device (91), article model (1A) is inserted to the inner side of all shape-memory members (85), and balloon (91A) set on the outer side of each shape-memory member (85) is inflated under pressure. As a result, shape-memory member (85) set between said balloons (91A) and article model (1A) is deformed to the article holding shape.

[0080]

Consequently, by means of shape change device (90), article holder (80) performs shape change as follows.

(1) By means of a heater (not shown in the figure), shape-memory member (85) of article holding member (84) is heated to above a prescribed temperature so that it recovers the initial flat memory shape (Figure 11).

[0081]

(2) Shape-memory member (85) that has been heated to over a prescribed temperature is deformed to the article holding shape by means of shape imparting device (91). In this case, balloons (91A) of shape imparting device (91) are pressurized and inflated (Figure 13(A)).

[0082]

(3) By means of a cooler (not shown in the figure), shape-memory member (85) is cooled to lower than a prescribed temperature, and said article holding shape is fixed. Then, balloons

(91A) of shape imparting device (91) have gas exhausted from them and are shrunk (Figure 13(B)).

[0083]

(Third embodiment) (Figures 14, 15)

(Article holder (100)) (Figures 14 and 15)

Article holder (100) has article holding member (102) set in circular box-shaped base member (101). Article holding member (102) is composed of ten shape-memory members (103) in bent rectangular shape. The upper end portions of shape-memory members (103) are fixed on the upper end surface of base member (101), and the lower end portions of shape-memory members (103) go through guide holes (104) formed on the side wall of base member (101) and extend out.

[0084]

Shape-memory members (103) have the same shape and are made of the same type of alloy as shape-memory alloy (23) of shape-memory member (21) in the first embodiment. Consequently, for shape-memory members (103), (a) at a temperature over a prescribed temperature (shape recovering temperature A_f), they recover the initial memory shape (in a state in which the gap between facing shape-memory members (103), (103) is smaller than the diameter of the holding object article) (Figure 14), and they can be deformed at will to the article holding shape fitting the article model. Then, (b) in the application temperature region (room temperature) lower than a prescribed temperature (shape recovering temperature A_f), said article holding shape is fixed to form article holding region (105) (Figure 15).

[0085]

The method and device for shape change of article holder (100) are the same as those for article holder (10) in the first embodiment, and the operation is performed as follows.

(1) The gap between facing shape-memory members (103), (103) of article holding member (102) is made larger than the size of article model (1A), and article model (1A) is inserted in-between shape-memory members (103), (103).

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[0086]

(2) By means of the heater, shape-memory members (103) of article holding member (102) are heated to over a prescribed temperature, and they recover their initial memory shape (Figure 14). In this process, shape-memory members (103) fit article model (1A), and the article holding shape is imparted to shape-memory members (103).

[0087]

(3) By means of the cooler, the aforementioned article holding shape of shape-memory member (103) is fixed as the temperature drops to below than a prescribed temperature.

[0088]

(Fourth embodiment) (Figures 16, 17)

(Article holder (110)) (Figure 16)

Article holder (110) has the same basic constitution as that of article holder (10). Article holder (110) differs from article holder (10) in that the first article holding shape A with the highest frequency of application among the various types of articles (instead of a flat plate shape) is memorized as the initial memory shape of shape-memory member (18) that forms article holding member (14).

[0089]

In this case, the initial memory shape of shape-memory member (18) (first article holding shape A) is formed as follows: (1) A shape-memory memory (or shape-memory alloy) is molded and solidified from the melt state to the desired first article holding shape A; or (2) a molding feed material (such as a flat plate) of the shape-memory resin (or shape-memory alloy) is heated to near the melting point, and at this temperature, it is molded and solidified into the first article holding shape A.

[0090]

For example, shape-memory member (18) made of shape-memory polymer "DALLY" [transliteration] manufactured by Mitsubishi Heavy Industries, Ltd. may be molded to the first article holding shape A while heated at 130°C (near the melting point) for 15 min.

[0091]

Consequently, shape-memory member (18) of article holder (10) is composed of first article holding region (19A) explained in (A) below and second article holding region (19B) explained in (B) below.

(A) First article holding region (19A)

For shape-memory member (18), (a) no matter what shape it is in the application temperature region (room temperature), when it is heated to over a prescribed temperature (glass transition point T_g), it recovers the initial memory shape, that is, the first article holding shape A.
(b) When said shape-memory member (18) is cooled to the application temperature region (room

temperature) lower than a prescribed temperature (glass transition point T_g), said first article holding shape A is fixed as first article holding region (19A).

[0092]

Also, for article holder (110), first article holding shape A of shape-memory member (18) may be set permanently as the unique prescribed shape, or it may be changed by means of shape change device (120) to be explained later.

[0093]

(B) Second article holding region (19B)

For shape-memory member (18), (a) at a temperature over a prescribed temperature (glass transition point T_g), it can recover first article holding shape A as the initial memory shape, and it can be deformed at will from said first article holding shape A to second article holding shape B fitting the article model. Then, (b) in the application temperature region (room temperature) lower than a prescribed temperature (glass transition point T_g), said second article holding shape B is fixed, and second article holding region (19B) is formed.

[0094]

For example, for shape-memory member (18) made of shape-memory polymer “DIALLY” [transliteration] manufactured by Mitsubishi Heavy Industries, Ltd., glass transition point T_g is about 30-100°C, depending on the type of the feed material. First article holding shape A can be changed to second article holding shape B by heating at 80°C for 1 min.

[0095]

As shown in Figure 16, according to first article holding shape A memorized in shape-memory member (18), first article holding region (19A) that can hold article (1) with a larger diameter and with a high application frequency is formed, and, according to second article holding shape B imparted on shape-memory member (18), second article holding region (19B) that can hold article (1) having a smaller diameter is formed.

[0096]

(Method and device for shape change of article holder (110)) (Figure 7)

For shape change device (120) of article holder (110), the main function is to change second article holding shape B imparted on shape-memory member (18) of article holding member (14) that forms article holder (10) to various shapes. Just as shape change device (60) for article holder (10), it also has article holding member feeding device (61), heater (62), shape

imparting device (63), cooler (64), height adjusting member feeding device (65), and article holding member setting device (66). Also, for shape change device (120), it is possible to impart or reset first article holding shape A itself as the initial memory shape imparted to shape-memory member (18), and it has initial memory shape setting line (75). On said initial memory shape setting line (75), there are initial heater (67), initial shape imparting device (68), and cooler (69).

[0097]

Consequently, for article holder (110), by means of shape change device (120), the initial setting operation as described in following (A) and the shape change operation as explained in following (B) are performed.

(A) Initial setting operation

(1) By means of article holding member feeding device (61), article holding member (14) is taken out from first base member (11) and second base member (12), and said article holding member (14) is fed to initial heater (67).

[0098]

(2) By means of initial heater (67), shape-memory member (18) of article holding member (14) is heated to near the melting point.

[0099]

(3) By means of initial shape imparting device (68), first article holding shape A is imparted to said shape-memory member (18) that has been heated to near the melting point.

[0100]

(4) By means of cooler (69), shape-memory member (18) is cooled, and first article holding shape A is fixed as the initial memory shape.

[0101]

(5) As needed, by means of height adjusting member feeding device (65), height adjusting member (13) is joined to first base member (11) and second base member (12).

[0102]

(6) By means of article holding member setting device (66), article holding member (14) in said step (4) is set on first base member (11) and second base member (12) as well as height adjusting member (13) in said step (5), and setting of article holder (110) with first article holding shape A imparted as the initial memory shape is completed.

[0103]

(B) Shape change operation

(1) By means of article holding member feeding device (61), article holding member (14) is taken out from first base member (11) and second base member (12), and said article holding member (14) is fed to heater (62).

[0104]

(2) By means of heater (62), shape-memory member (18) of article holding member (14) is heated to over a prescribed temperature so that it recovers the initial memory shape (first article holding shape A).

[0105]

(3) Second article holding shape B is applied by shape imparting device (63) on shape-memory member (18) that has been heated to over a prescribed temperature.

[0106]

(4) By means of cooler (64), shape-memory member (18) is cooled, and second article holding shape B is fixed.

[0107]

(5) As needed, by means of height adjusting member feeding device (65), height adjusting member (13) is joined to first base member (11) and second base member (12).

[0108]

(6) By means of article holding member setting device (66), article holding member (14) in said step (4) is set on first base member (11) and second base member (12) as well as height adjusting member (13) in said step (5), and setting of article holder (110) with second article holding shape B imparted to it is completed.

[0109]

Consequently, in this embodiment, the following functions can be realized. Shape-memory member (18) that forms article holding member (14) has the first article holding shape imparted to it as the initial memory shape. Also, it can be deformed to various second article holding shapes B corresponding to the various desired article shapes, respectively, and it can be fixed at said second article holding shape B. That is, with a simple structure of article

holding member (14) made of shape-memory member (18), first article holding shape A as the initial memory shape and various second holding shapes B obtained by deformation of said first article holding shape can be formed, and it is possible to hold articles in various shapes in a stable.

[0110]

After first article holding shape A of article holding member (14) is imparted as the initial memory shape, when the member is set at a temperature higher than a prescribed temperature (glass transition point T_g), it recovers to first article holding shape A as the initial memory shape. As it is cooled down to an application temperature region (room temperature) lower than a prescribed temperature (glass transition point T_g) while said first article holding shape A is maintained as is, the first article holding shape is fixed to form first article holding region A. Consequently, once the article shape with a high frequency of use among the various article holding shapes is memorized as first article holding shape A, that is, as the initial memory shape, then later, when the article holding member for another article holding shape (second article holding shape B) is heated to above a prescribed temperature, said first article holding shape A can be obtained. As a result, it is possible to reduce the shape change frequency of article holding member (14).

[0111]

In this case, one may make use of a shape-memory resin and a shape-memory alloy as shape-memory member (18). When they are both heated to over a prescribed temperature, they recover the initial memory shape (first article holding shape A), and they can be deformed at will into another article holding shape (second article holding shape B) that fits the prescribed selected article model. When both are cooled down to the application temperature region lower than a prescribed temperature, the aforementioned article holding shapes (first and second article holding shapes A and B) are fixed to form article holding regions (first and second article holding regions (19A), (19B)).

[0112]

In the above, embodiments of this invention have been explained in detail with reference to figures. However, the specific constitution of this invention is not limited to said embodiments. As long as the gist of this invention is observed, various changes can be made in the design. For example, the base member is not a necessity for the article holder. One may make use of the article holding member also as a base member. For the shape-memory resin used as the shape-memory member that forms the article holding member in this invention, in order to

avoid swelling of the resin due to absorption of moisture, it is preferred that its surface be subjected to a water repelling treatment before use.

[0113]

Also, for article holder (10) (also for article holder (50)), height adjusting member (13) is held on base member (12), and article holding member (14) is held on height adjusting member (13), (a) while positioning pins (12D) formed on the upper end surface of base member (12) are engaged to positioning holes (13A) formed on the lower end surface of height adjusting member (13), sucking thin-sheet ring (16) on the lower end surface of height adjusting member (13) is magnetically held on sucking thin-sheet ring (15) on the upper end surface of base member (12), and, at the same time, (b) while positioning pins (13B) formed on the upper end surface of height adjusting member (13) are engaged to positioning holes (14A) formed on the lower end surface of article holding member (14), sucking thin-sheet ring (16) on the lower end surface of article holding member (14) is magnetically held on thin suction sheet ring (15) on the upper end surface of height adjusting member (13). However, one may also adopt the following scheme for holding height adjusting member (13) on base member (12) and for holding article holding member (14) on height adjusting member (13). As shown in Figure 18, (a) while large-diameter annular portion (202) on the lower end surface of height adjusting member (13) is fit on small-diameter annular portion (201) formed on the upper end surface of base member (12), spring plunger (204) buried in the inner peripheral portion of large-diameter annular portion (202) of article holding member (13) is engaged to engagement recess (203) formed on the outer peripheral portion of small-diameter annular portion (201) of base member (12), so that height adjusting member (13) is held on base member (12); (b) while large-diameter annular portion (212) on the lower end surface of article holding member (14) is fit on small-diameter annular portion (211) formed on the upper end surface of height adjusting member (13), spring plunger (214) buried in the inner peripheral portion of large-diameter annular portion (212) of article holding member (14) is engaged to engagement recess (213) formed on the outer peripheral portion of small-diameter annular portion (211) of height adjusting member (13), so that article holding member (14) is held in article holding member (13). In this case, spring plunger (204) (also spring plunger (214)), compressive spring (204B) and ball (204C) are contained in case (204A) buried in height adjusting member (13) and article holding member (14). While the equatorial portion of ball (204C) is engaged to the opening portion of case (204A) such that ball (204) does not fly out from case (204A), ball (204C) is pressed outward by compressive spring (204B).

[0114]

Effect of the invention

As explained above, according to this invention, with a simple structure, various articles in different shapes can be held stably.

Brief description of the figures

Figure 1 is a schematic diagram illustrating the article holder in the first embodiment of this invention.

Figure 2 is a schematic diagram illustrating the article holding member.

Figure 3 is a schematic diagram illustrating another example of the article holding member.

Figure 4 is a schematic diagram illustrating the article holding state.

Figure 5 is an oblique view illustrating the article holder.

Figure 6 is an oblique view illustrating on exploded state of the article holder.

Figure 7 is a schematic diagram illustrating a modified example of the article holding member.

Figure 8 is a schematic diagram illustrating a modified example of the article holder.

Figure 9 is a schematic diagram illustrating the shape change line of the article holder.

Figure 10 is a schematic diagram illustrating the shape imparting device.

Figure 11 is a schematic diagram illustrating the article holder in the second embodiment.

Figure 12 is a schematic diagram illustrating the article holding state.

Figure 13 is a schematic diagram illustrating the shape imparting device.

Figure 14 is a schematic diagram illustrating the article holder in the third embodiment of this invention.

Figure 15 is a schematic diagram illustrating the article holding state.

Figure 16 is a schematic diagram illustrating the article holder in the fourth embodiment.

Figure 17 is a schematic diagram illustrating the shape change line for the article holder.

Figure 18 is a schematic diagram illustrating a modified example of the article holder.

Brief description of reference numbers

1	Article
1A	Article model
10, 110	Article holder
11, 12	Base member
13	Height adjusting member
14, 20	Article holding member

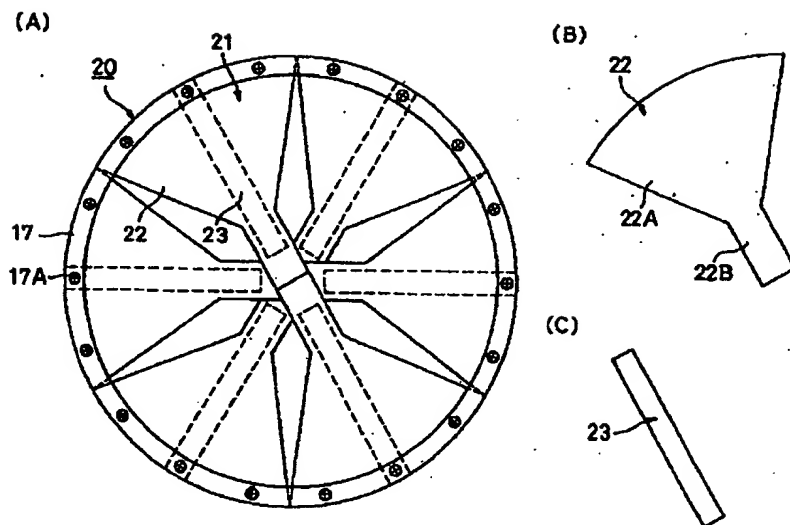


Figure 3

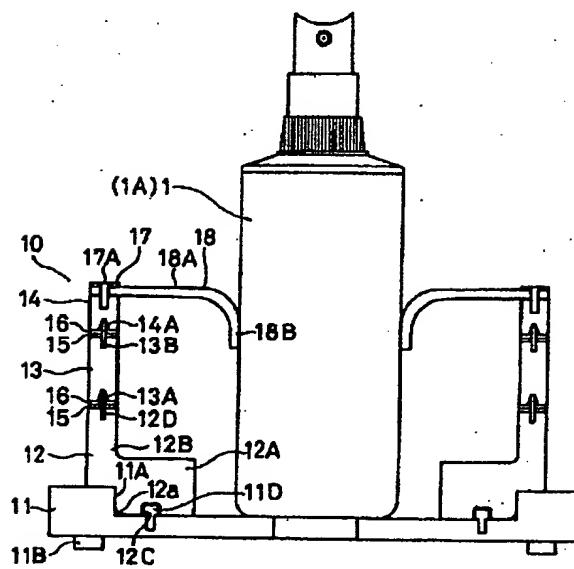


Figure 4

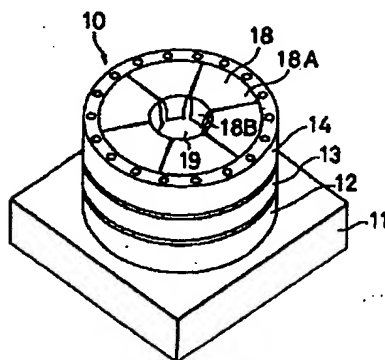


Figure 5

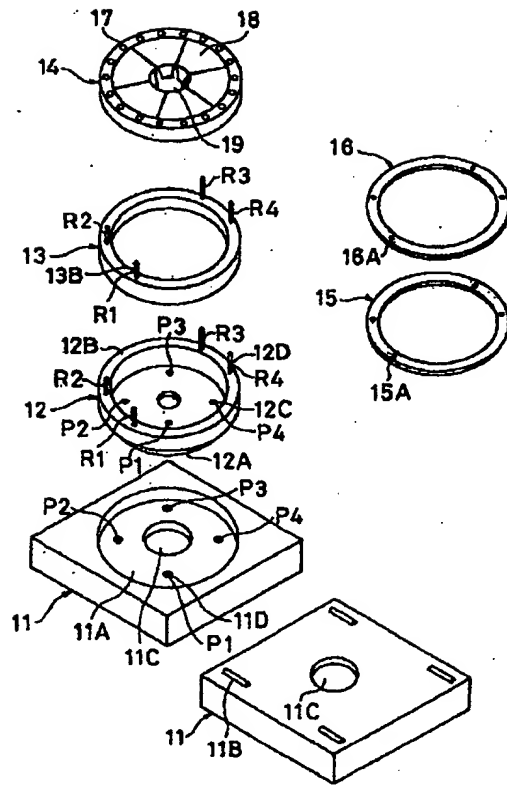


Figure 6

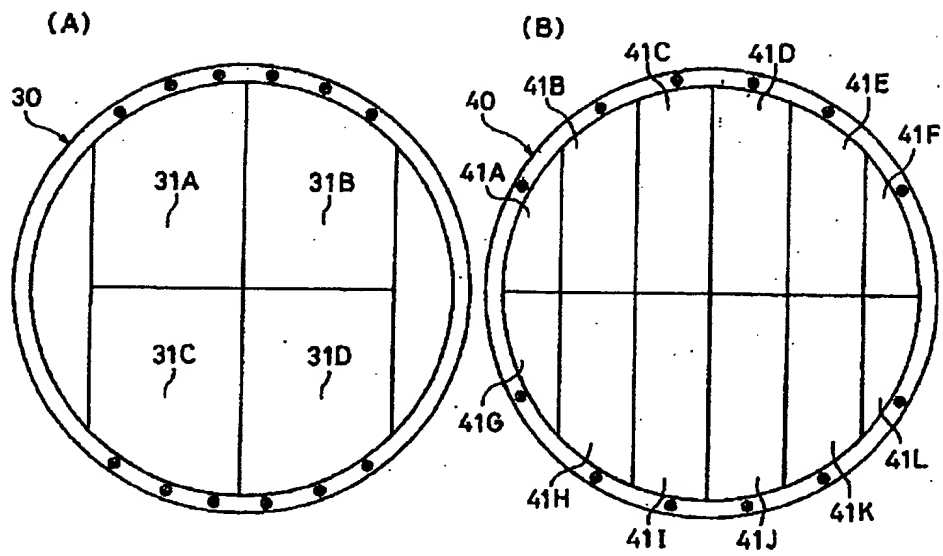


Figure 7

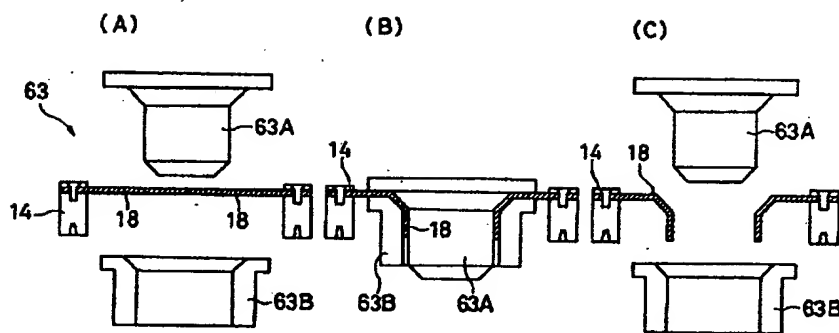


Figure 10

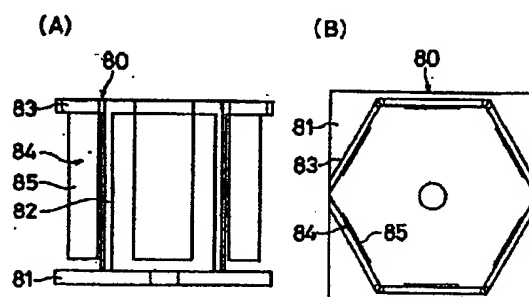


Figure 11

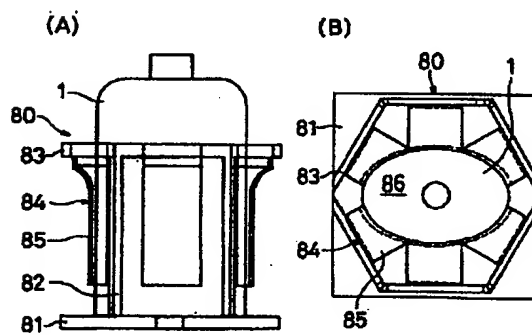


Figure 12

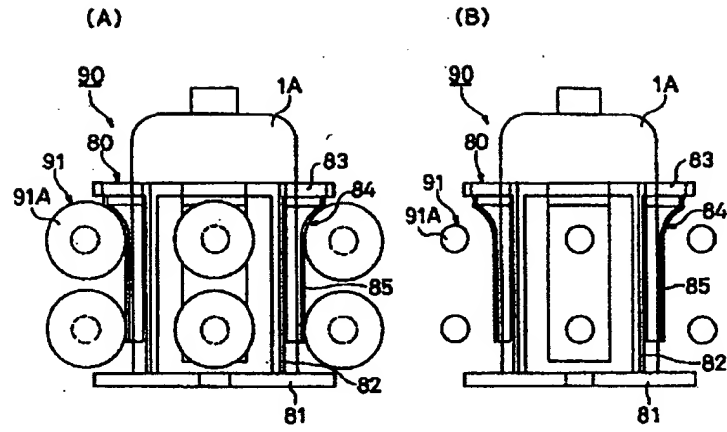


Figure 13

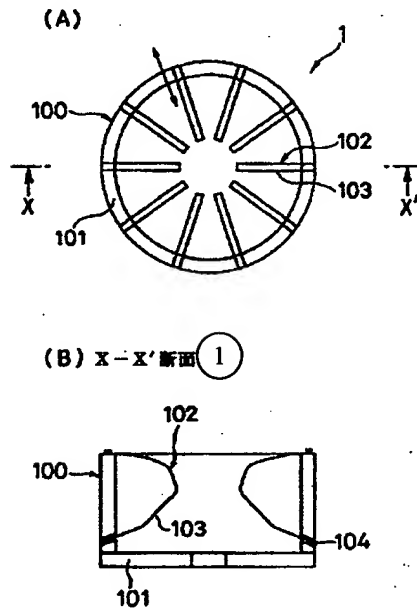


Figure 14

Key: 1 (B) X-X' cross-sectional view

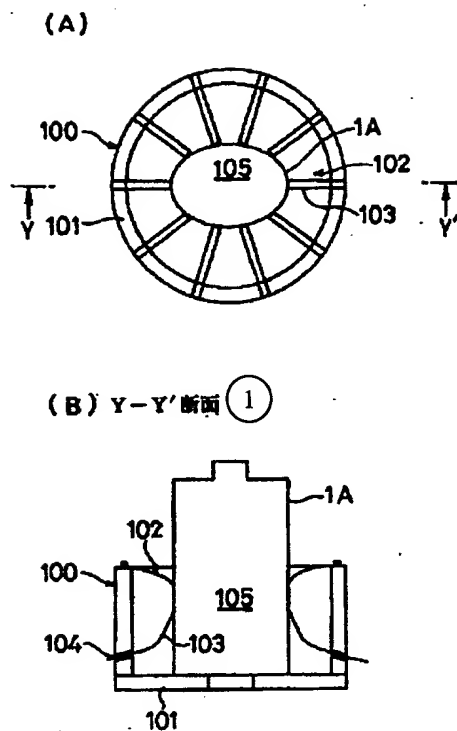


Figure 15

Key: 1 (B) Y-Y' cross-sectional view

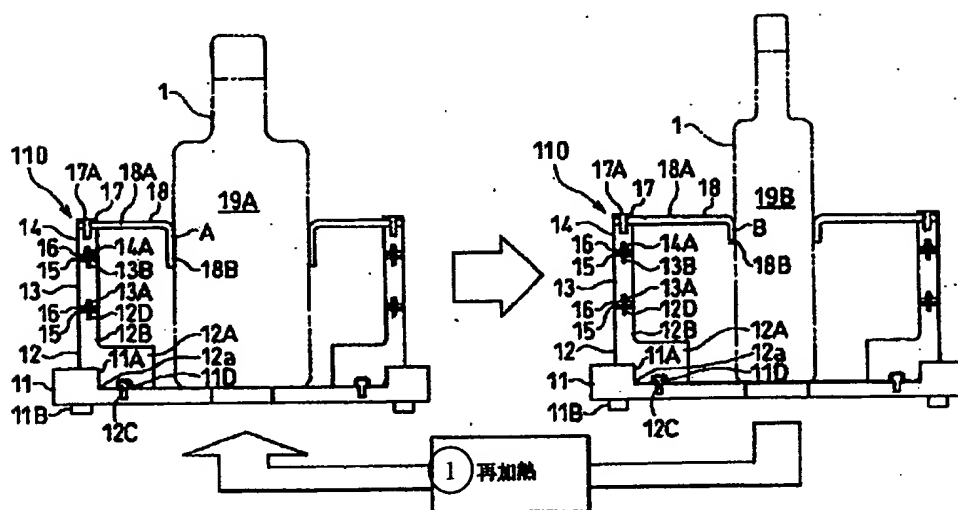


Figure 16

Key: 1 Reheating

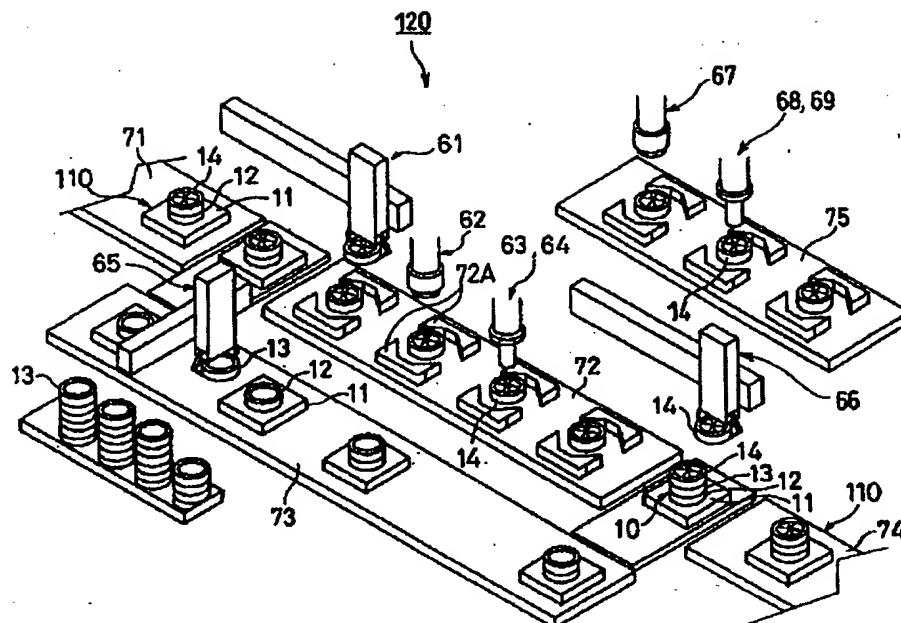


Figure 17

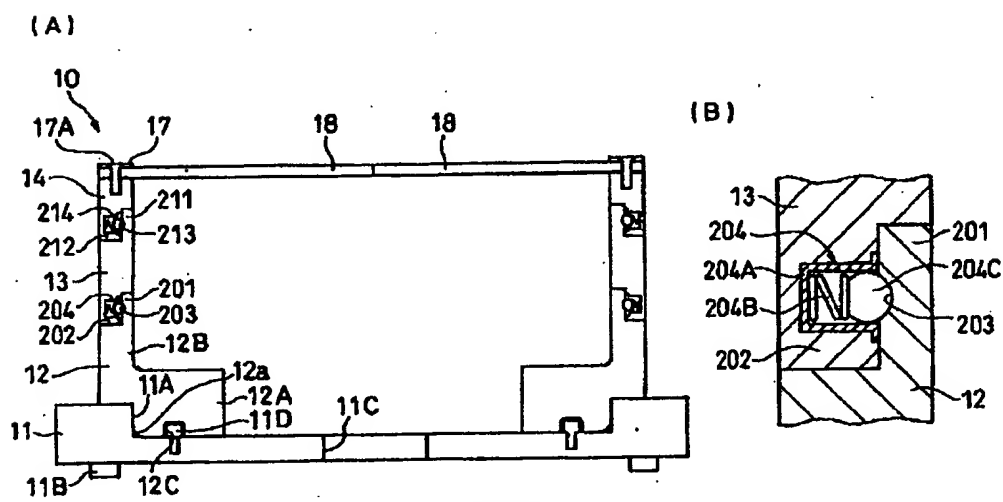


Figure 18

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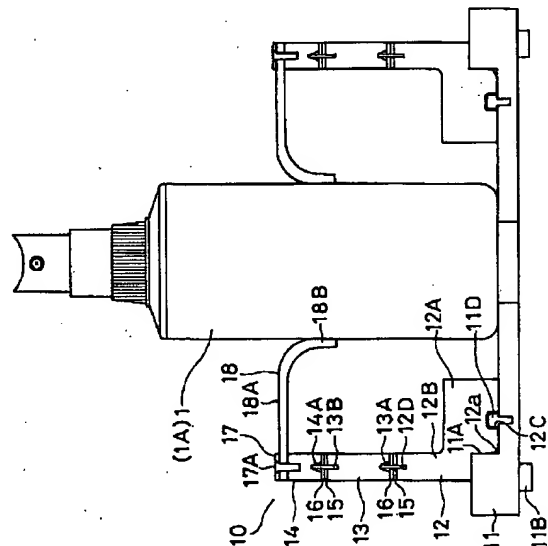
(74) 代理人 弁理士 塩川 修治

(54) 【発明の名称】 物品保持具

(57) 【要約】

【課題】 簡易な構成により、各種形状の物品を安定的に保持すること。

【解決手段】 物品保持具10において、物品保持部材14が形状記憶部材18により構成され、形状記憶部材18は一定温度より高温で物品モデル1Aに衝合し得る物品保持形状に変形でき、一定温度より低温の使用温度域で上記物品保持形状を固定化して物品保持領域19を形成するもの。



【特許請求の範囲】

【請求項1】 物品保持部材を有し、この物品保持部材により物品を保持可能となる物品保持具において、物品保持部材が形状記憶部材により構成され、形状記憶部材は一定温度より高温で所望の物品形状に衝合し得る物品保持形状に変形でき、一定温度より低温の使用温度域で上記物品保持形状を固定化して物品保持領域を形成することを特徴とする物品保持具。

【請求項2】 物品保持部材を有し、この物品保持部材により物品を保持可能となる物品保持具において、物品保持部材が形状記憶部材により構成され、形状記憶部材は第1の物品形状に衝合し得る第1の物品保持形状を初期記憶形状として記憶せしめられて第1の物品保持領域を形成するとともに、一定温度より高温で第1の物品保持形状から第2の物品保持形状に衝合し得る第2の物品保持形状に変形でき、一定温度より低温の使用温度域で第2の物品保持形状を固定化して第2の物品保持領域を形成することを特徴とする物品保持具。

【請求項3】 前記形状記憶部材が、形状記憶樹脂により構成される請求項1又は2記載の物品保持具。

【請求項4】 前記形状記憶部材が、形状記憶樹脂と形状記憶合金との複合体である請求項1又は2記載の物品保持具。

【請求項5】 前記物品保持部材が、複数個の形状記憶部材からなり、各形状記憶部材は物品保持領域の回りに放射状をなすように配置される請求項1～4のいずれかに記載の物品保持具。

【請求項6】 前記形状記憶部材の物品保持領域に臨む先端部が平板状をなす請求項5記載の物品保持具。

【請求項7】 前記物品保持部材をベース部材に設け、このベース部材と物品保持部材との間に、高さ調節用部材を介装してなる請求項1～6のいずれかに記載の物品保持具。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、充填やキャッピングを伴う容器処理工程等において、容器等の物品を保持するに好適な物品保持具に関する。

【0002】

【従来の技術】従来、物品保持具として、特開平4-154550号公報（従来技術1）、特開平4-279497号公報（従来技術2）がある。

【0003】従来技術1は、ベース部材に物品保持部材を設け、この物品保持部材により物品を保持可能とするに際し、物品保持部材を弾性シート材料からなる複数の保持片により構成することとしている。保持片を弾性シート材料により構成し、種々の物品形状に対応させようとしたものである。

【0004】従来技術2は、ベース部材にV形フィンガー一からなる物品保持部材を設け、このV形フィンガーを

サーボドライバにより保持対象物品に対応する所望の位置に位置決めし、種々の物品形状に対応させようとしたものである。

【0005】

【発明が解決しようとする課題】従来技術には以下の如くの問題点がある。

①従来技術1では、弾性シート材料の弾性変形の範囲で保持できる物品形状の寸法範囲は小さい。このため、物品形状によっては、弾性シート材料が物品に加える弾性保持力に強弱のばらつきを生じ、安定した保持ができない。従って、実質的に保持できる物品形状は限定的になる。

【0006】②従来技術2は、V形フィンガーの位置制御を行なうものであるため、機械的及び電氣的に極めて複雑である。また、V形フィンガーの物品を保持するV字面の形状は固定的であり、これによって保持できる物品形状は限定的である。

【0007】本発明の課題は、簡易な構成により、各種形状の物品を安定的に保持することにある。

【0008】

【課題を解決するための手段】請求項1に記載の本発明は、物品保持部材を有し、この物品保持部材により物品を保持可能となる物品保持具において、物品保持部材が形状記憶部材により構成され、形状記憶部材は一定温度より高温で所望の物品形状に衝合し得る物品保持形状に変形でき、一定温度より低温の使用温度域で上記物品保持形状を固定化して物品保持領域を形成するようにしたものである。

【0009】請求項2に記載の本発明は、物品保持部材を有し、この物品保持部材により物品を保持可能となる物品保持具において、物品保持部材が形状記憶部材により構成され、形状記憶部材は第1の物品形状に衝合し得る第1の物品保持形状を初期記憶形状として記憶せしめられて第1の物品保持領域を形成するとともに、一定温度より高温で第1の物品保持形状から第2の物品保持形状に衝合し得る第2の物品保持形状に変形でき、一定温度より低温の使用温度域で第2の物品保持形状を固定化して第2の物品保持領域を形成するようにしたものである。

【0010】請求項3に記載の本発明は、請求項1又は2に記載の本発明において更に、前記形状記憶部材が、形状記憶樹脂により構成されるようにしたものである。

【0011】請求項4に記載の本発明は、請求項1又は2に記載の本発明において更に、前記形状記憶部材が、形状記憶樹脂と形状記憶合金との複合体であるようにしたものである。

【0012】請求項5に記載の本発明は、請求項1～4のいずれかに記載の本発明において更に、前記物品保持部材が、複数個の形状記憶部材からなり、各形状記憶部材は物品保持領域の回りに放射状をなすように配置され

るようにしたものである。

【0013】請求項6に記載の本発明は、請求項5に記載の本発明において更に、前記形状記憶部材の物品保持領域に臨む先端部が平板状をなすようにしたものである。

【0014】請求項7に記載の本発明は、請求項1～6のいずれかに記載の本発明において更に、前記物品保持部をベース部材に設け、このベース部材と物品保持部材との間に、高さ調節用部材を介装してなるようにしたものである。

【0015】請求項1に記載の本発明によれば下記①の作用がある。

①物品保持部材を構成する形状記憶部材が各種の所望の物品形状（以下物品モデルという）に対応する物品保持形状に多様に変形でき、この物品保持形状を固定化できる。即ち、物品保持部材を形状記憶部材により構成するだけの簡易な構成により、多様な物品保持領域を形成でき、各種形状の物品を安定的に保持できる。

【0016】このとき、形状記憶部材としては、形状記憶樹脂と形状記憶合金とを用いることができる。両者はともに、一定温度より昇温することにより初期記憶形状（例えばフラット）に戻り、且つ物品モデルに衝合し得る物品保持形状に自由に変形できる。そして、両者は、一定温度より低温の使用温度域に降温すると、上記物品保持形状を固定化して物品保持領域を形成する。

【0017】請求項2に記載の本発明によれば下記②の作用がある。

②物品保持部材を構成する形状記憶部材が第1の物品保持形状を初期記憶形状として付与されるとともに、各種の所望の物品形状に対応する第2の物品保持形状に多様に変形でき、この第2の物品保持形状を固定化できる。即ち、物品保持部材を形状記憶部材により構成するだけの簡易な構成により、初期記憶形状としての第1の物品保持形状と、これを多様に変形した第2の物品保持形状とを形成でき、各種形状の物品を安定的に保持できる。

【0018】そして、物品保持部材の第1の物品保持形状を初期記憶形状として付与するから、一定温度（ガラス転移温度 T_g ）より高温で初期記憶形状である第1の物品保持形状に戻り、これをそのまま一定温度（ガラス転移温度 T_g ）より低温の使用温度域（常温）に降温させれば、この第1の物品保持形状を固定化された第1の物品保持領域を形成できる。従って、物品保持部材により保持される各種物品のうちで使用頻度の高い物品形状を第1の物品保持形状として初期記憶せしめておけば、一旦他の物品保持形状（第2の物品保持形状）を付与された物品保持部材を単に一定温度以上に昇温させるだけで上述の第1の物品保持形状を得ることができ、物品保持部材の型替え頻度を低減できる。

【0019】このとき、形状記憶部材としては、形状記憶樹脂と形状記憶合金とを用いることができる。両者は

ともに、一定温度より昇温することにより初期記憶形状（第1の物品保持形状）に戻り、且つ所望により選択された物品モデルに衝合し得る他の物品保持形状（第2の物品保持形状）に自由に変形できる。そして、両者は、一定温度より低温の使用温度域に降温することにより、上記物品保持形状（第1と第2の物品保持形状）を固定化されて物品保持領域（第1と第2の物品保持領域）を形成する。

【0020】請求項3に記載の本発明によれば下記③の作用がある。

③上記①、②において、使用温度域で物品保持形状を固定化された形状記憶部材の弾性率は、形状記憶合金と形状記憶樹脂の肉厚等に差異が少ない状態で用いる場合、形状記憶合金より形状記憶樹脂の方が高い。従って、形状記憶部材として形状記憶樹脂を用いる場合には、使用温度域での弾性率が高く、硬くなり、強い物品保持力を得て保持性能を向上できる。

【0021】請求項4に記載の本発明によれば下記④の作用がある。

④上記①、②において、新たな物品保持形状付与（型替え）のための前段作業として、形状記憶部材を一定温度より昇温して初期記憶形状に戻すときの復元力は、形状記憶樹脂より形状記憶合金の方が大きい。従って、形状記憶部材を形状記憶樹脂と形状記憶合金との複合体とすることにより、形状記憶部材の型替え時に迅速に初期記憶形状に戻し、型替えの迅速化を図ることができる。

【0022】請求項5に記載の本発明によれば下記⑤の作用がある。

⑤物品保持部材を構成する複数個の形状記憶部材を、物品保持領域の回りに放射状に配置したから、物品の全周を複数個の形状記憶部材のそれぞれによって安定的に保持できる。

【0023】請求項6に記載の本発明によれば下記⑥の作用がある。

⑥形状記憶部材の物品保持領域に臨む先端部が平板状をなすことにより、形状記憶部材は物品に平板状の面（点や線でなく）で接するものとなり、物品を安定的に保持できる。

【0024】請求項7に記載の本発明によれば下記⑦の作用がある。

⑦ベース部材と物品保持部材との間に高さ調節用部材を介装することにより、物品保持部材が物品に接する物品保持高さ位置を、物品の高さ等の形状に応じて物品をより安定的に保持できる位置に選定でき、物品を安定的に保持できる。

【0025】

【発明の実施の形態】図1は第1実施形態の物品保持具を示す模式図、図2は物品保持部材を示す模式図、図3は物品保持部材の他の例を示す模式図、図4は物品保持状態を示す模式図、図5は物品保持具を示す斜視図、図

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6は物品保持具の分解状態を示す斜視図、図7は物品保持部材の変形例を示す模式図、図8は物品保持具の変形例を示す模式図、図9は物品保持具の型替えラインを示す模式図、図10は形状付与装置を示す模式図、図11は第2実施形態の物品保持具を示す模式図、図12は物品保持状態を示す模式図、図13は形状付与装置を示す模式図、図14は第3実施形態の物品保持具を示す模式図、図15は物品保持状態を示す模式図、図16は第4実施形態の物品保持具を示す模式図、図17は物品保持具の型替えラインを示す模式図、図18は物品保持具の変形例を示す模式図である。

【0026】(第1実施形態)(図1～図10)

(物品保持具10)(図1～図6)

物品保持具10は、図1、図4～図6に示す如く、ベース部材としての第1と第2のベース部材11、12に、高さ調節用部材13を介して物品保持部材14を設け、この物品保持部材14により物品1(例えば容器)を保持可能とする。物品保持具10は、例えば充填やキャッピングを伴う容器処理ライン等で物品1をコンベヤにより搬送し、充填機の充填作業位置やキャッピング装置のキャッピング作業位置等に物品1を位置付ける等に用いられる。

【0027】第1ベース部材11は矩形状をなし、上面に第2ベース部材12の嵌合のための円形凹部11A、下面にコンベヤの送り用係合部に係合するための凸条部11B、中央に清掃用の貫通孔11Cを備えている。また、円形凹部11Aの底面の中心軸回りの4位置 $P_1 \sim P_4$ (矩形 $P_1 \sim P_4$ の角点)のそれぞれには、第2ベース部材12のための位置決めピン11Dが設けられている。

【0028】第2ベース部材12は円形状をなし、第1ベース部材11の円形凹部11Aに嵌合する円形凸部12Aと、円形凸部12Aの上の円形環状部12Bからなっている。尚、第2ベース部材12の円形凸部12Aの下端外周側角面部12aをテーパ状にして、第1ベース部材11の円形凹部11Aへの導入を容易としている。また、円形凸部12Aの下端面の中心軸回りの4位置 $P_1 \sim P_4$ のそれぞれには、第1ベース部材11の位置決めピン11Dに係入する位置決め孔12Cが設けられている。そして、円形環状部12Bの上端面の中心軸回りの4位置 $R_1 \sim R_4$ (矩形 $R_1 \sim R_4$ の角点)のそれぞれには、高さ調節用部材13のための位置決めピン12Dが設けられている。また、円形環状部12Bの上端面には、磁石、金属板等の磁性体からなる吸着用薄板リング15が接着剤等により接合されている。薄板リング15は、円形環状部12Bの位置決めピン12Dに挿通される孔15Aを備えている。

【0029】高さ調節用部材13は円環状をなし、下端面の中心軸回りの4位置 $R_1 \sim R_4$ のそれぞれに第2ベース部材12の位置決めピン12Dに係入する位置決め

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孔13Aを備え、上端面の中心軸回りの4位置 $R_1 \sim R_4$ のそれぞれに物品保持部材14のための位置決めピン13Bを備えている。位置決め孔13Aは位置決めピン12Dを導入容易とするためのテーパ状開口孔(図1)とするのが良い。また、高さ調節用部材13の下端面には、磁石、金属板等の磁性体からなる吸着用薄板リング16が接着剤等により接合されている。薄板リング16は、高さ調節用部材13の位置決め孔13Aに合致する孔16Aを備えている。また、高さ調節用部材13の上端面には、第2ベース部材12の円形環状部12Bの上端面に設けたと同様の薄板リング15が接合される。

【0030】物品保持部材14は円環状をなし、下端面の中心軸回りの4位置 $R_1 \sim R_4$ のそれぞれに高さ調節用部材13の位置決めピン13Bに係入する位置決め孔14Aを備え、上端面には固定リング17により固定される複数個(本実施形態では6個)の形状記憶部材18が水平状に設けられている。固定リング17はビス17Aにより形状保持部材14の上端面に取着される。また、形状保持部材14の下端面には、高さ調節用部材13の下端面に設けたと同様の薄板リング16が接合される。

【0031】即ち、物品保持部材14は、図2に示す如く、6個の形状記憶部材18からなり、各形状記憶部材18は中心軸回りに放射状をなすように配置され、それらの先端部により物品保持領域19(図5、図6)を形成することとしている。このとき、各形状記憶部材18は、形状記憶樹脂(例えば三菱重工業株式会社製の形状記憶ポリマー「ダイアリィ」)からなる平板を加工して形成されたものであり、図2に示す如く、固定リング17により固定される基端部側を扇形状部18Aとし、物品保持領域19に臨むこととなる先端部を平板矩形形状部18Bとしている。

【0032】然るに、形状記憶部材18は、上述した如く形状記憶樹脂から構成されたから、(a)一定温度(ガラス転移温度 T_g)より高温で初期記憶形状(例えば平板)に戻り、且つ物品モデルに衝合し得る物品保持形状に自由に変形できる。そして、(b)一定温度(ガラス転移温度 T_g)より低温の使用温度域(常温)で、上記物品保持形状を固定化されて物品保持領域19を形成する。図1、図2の形状記憶部材18は平板状の初期記憶形状をなし、図4、図5の形状記憶部材18は横断面が楕円形の容器を保持するための物品保持形状を固定化されたものである。

【0033】従って、物品保持具10にあっては、物品保持部材14の形状記憶部材18に、保持対象物品と同一形状の物品モデル(所望の物品形状)を用いた物品保持形状を上記(a)、(b)により付与するものとすれば、形状記憶部材18は物品保持領域19の回りで少なくとも平板矩形形状部18Bを図4に示す如くに湾曲状に変形させた物品保持形状を得て物品1の外形を安定的に保持

できる。このとき、形状記憶樹脂からなる形状記憶部材18は物品保持形状を固定化された使用温度域で高い弾性率を示すから、使用温度域で硬く、強い物品保持力を得ることができる。

【0034】尚、形状記憶部材18は物品保持形状を付与するに際し、物品モデルを保持対象物品サイズより小径とすれば物品保持領域19での物品保持力を強くするものとなり、物品モデルを保持対象物品サイズより大径とすれば物品保持領域19への物品挿入のスムーズを図ることができる。

【0035】また、物品保持部材14にあっては、6個の形状記憶部材18を物品保持領域19回りに放射状に配置したから、物品1の全周を6個の形状記憶部材18のそれぞれによって安定的に保持できる。尚、物品保持部材14にあっては、保持対象物品1の横断面が楕円形るとき、楕円形の長軸方向が物品保持部材14内で同一直径上に位置する一対の形状記憶部材18、18の中心線方向に合致するようにし、これらの形状記憶部材18の幅方向中央部で楕円形の長軸方向側面を安定的に保持できるようにしている。

【0036】また、物品保持部材14にあっては、形状記憶部材18において、物品保持形状を付与されて物品保持領域19に臨むこととなる先端部を平板矩形形状部18Bとしたから、形状記憶部材18の平板矩形形状部18Bが物品1に平板状の面で接して、物品1を安定的に保持できる。

【0037】また、物品保持部材14にあっては、図2に示す形状記憶部材18の初期記憶形状において、全ての形状記憶部材18の平板矩形形状部18Bに中心部での重なりを持たせた。これにより、保持対象物品サイズが極小径であっても、形状記憶部材18は物品保持領域19の回りで平板矩形形状部18Bを必ず湾曲状に変形させた物品保持形状を得て、当該極小径物品のための物品保持領域19を確実に形成できる。即ち、極小径物品1にも対応できる。

【0038】また、物品保持部材14にあっては、図2に示す形状記憶部材18の初期記憶形状において、全ての形状記憶部材18が隣り合う他の形状記憶部材18との間に間隙gを介している。これにより、各形状記憶部材18が前述の(a)においてフラットな初期記憶形状に戻るとき、物品モデルにより物品保持形状を与えられるように湾曲状に変形するときのいずれにおいても、それら形状付与のための変形に対し、隣同士の形状記憶部材18のエッジが互いに擦れたり干渉したりすることによる外乱を及ぼすことがない。従って、物品保持形状を付与された形状記憶部材18（特に平板矩形形状部18B）は中心軸回りに傾きや歪のないストレートな物品保持面を形成し、物品1を安定的に保持できる。

【0039】以下、物品保持具10の組立手順について説明する（図6）。

(1) 第1ベース部材11の円形凹部11Aに設けた位置決めピン11Dに第2ベース部材12の円形凸部12Aに設けた位置決め孔12Cを係入し、第2ベース部材12を第1ベース部材11に嵌合する。

【0040】(2) 第2ベース部材12の円形環状部12Bに設けた位置決めピン12Dに高さ調節用部材13の位置決め孔13Aを係入する。同時に、第2ベース部材12の円形環状部12Bの上端面に設けた薄板リング15に、高さ調節用部材13に設けた薄板リング16を磁力により吸着せしめる。このとき、薄板リング15と薄板リング16の少なくとも一方が磁石からなるものであれば良い。

【0041】(3) 高さ調節用部材13の位置決めピン13Bに物品保持部材14の位置決め孔14Aを係入する。同時に、高さ調節用部材13の上端面に設けた薄板リング15に、物品保持部材14に設けた薄板リング16を磁力により吸着せしめる。このとき、薄板リング15と薄板リング16の少なくとも一方が磁石からなるものであれば良い。

20 【0042】上記(1)～(3)による物品保持具10の組立の結果、前述した如く、保持対象物品1の横断面が楕円形をなすとき、楕円形物品1の長軸方向が物品保持部材14内で同一直径上に位置する一対の形状記憶部材18、18の中心線方向に合致するように、更には楕円形物品1の長軸方向が物品保持具10のコンベヤによる搬送方向に合致するように、第1と第2のベース部材11、12、高さ調節用部材13、物品保持部材14の4者を係合せしめる。物品保持具10のコンベヤによる搬送方向は、第1ベース部材11において下面の凸条部11Bに直交する方向であるから、この第1ベース部材11のこの方向に対し、第1ベース部材11の円形凹部11Aに設ける位置決めピン11D、第2ベース部材12の円形凸部12Aに設ける位置決め孔12Cの4位置P₁～P₄がなす矩形の位置、第2ベース部材12の円形環状部12Bに設ける位置決めピン12D、高さ調節用部材13に設ける位置決め孔13A、位置決めピン13B、物品保持部材14に設ける位置決め孔14Aの4位置R₁～R₄がなす矩形の位置を予め適宜に設定しておくことにより、それら第1と第2のベース部材11、12、高さ調節用部材13、物品保持部材14の4者の組立の結果、楕円形物品1の長軸方向が物品保持部材14内で同一直径上に位置する一対の形状記憶部材18、18の中心線方向に合致し、且つ楕円形物品1の長軸方向が物品保持具10のコンベヤによる搬送方向に合致する組立結果を自然に（人手による組立ミスなく）得ることができる。この組立結果によれば、前述の如く、物品保持部材14内で同一直径上に位置する一対の形状記憶部材18、18により、それらの幅方向中央部で楕円形物品1の長軸方向側面を安定的に保持し、且つ楕円形物品1の長軸方向両側面に挟まれる幅広正面部をコンベヤの

側方に臨ませる搬送姿勢を確保できる。

【0043】尚、物品保持具10にあっては、第1ベース部材11と第2ベース部材12を分離し、第1ベース部材11の円形凹部11Aに第2ベース部材12の円形凸部12Aを嵌合させたので、第2ベース部材12の円形凸部12Aを第1ベース部材11の円形凹部11Aに対して90度回転してそれらの位置決めピン11Dと位置決め孔12Cとを係入させることにより、第1ベース部材11の凸条部11Bにより定まるコンベヤの搬送方向に対する物品1の搬送姿勢の方向性を直ちに容易に変更（楕円形物品1の幅広正面部をコンベヤの側方もしくは前方のいずれかに向ける等）できる。

【0044】また、物品保持具10にあっては、第1ベース部材11の矩形の例えば長辺がコンベヤ搬送方向に沿う方向となるように当該矩形内で凸条部11Bを設置するものとする事により、物品1の搬送姿勢の方向性を容易に特定化できる。然しながら、物品1の搬送姿勢の方向性を問わない場合には、第1ベース部材11は必ずしも矩形であることを要さず、円形等であっても良い。

【0045】（物品保持部材20）（図3）

図3の物品保持部材20が前述の物品保持部材14と異なる点は、物品保持部材20を構成する形状記憶部材21を、形状記憶樹脂22と形状記憶合金23との複合体としたことにある。形状記憶樹脂22と形状記憶合金23が、固定リング17及びビス17Aにより物品保持部材20に固定される点は、物品保持部材14におけると同じである。

【0046】形状記憶樹脂22は、物品保持部材14における形状記憶部材18と同様に、例えば三菱重工業株式会社製の形状記憶ポリマー「ダイアリィ」からなり、扇形状部22Aと平板矩形部22Bとを備える。形状記憶合金23は、形状記憶樹脂22の裏面の中心線上に添設される短冊状をなし、例えば大同特殊鋼株式会社製のNi-Ti合金「K10K ALLOY」からなる。

【0047】形状記憶部材21は、形状記憶樹脂22と形状記憶合金23とから構成されたから、(a)一定温度（ガラス転移温度 T_g 、もしくは形状回復温度 A_f ）より高温で形状記憶合金23の方が形状記憶樹脂22より弾性率が大きいので、形状記憶樹脂22は形状記憶合金23によって迅速に初期記憶形状（例えば平板）に戻り、且つ物品モデルに衝合し得る物品保持形状に自由に変形できる。そして、(b)一定温度（ガラス転移温度 T_g 、もしくは形状回復温度 A_f ）より低温の使用温度域（常温）で、上記物品保持形状を固定化して物品保持領域19を形成する。

【0048】このとき、形状記憶部材21の形状記憶樹脂22は、物品保持形状を固定化された使用温度域で高い弾性率を示すから、使用温度域で硬く、強い物品保持力を得ることができる。また、形状記憶部材21の形状

記憶合金23は、新たな物品保持形状付与（型替え）のための前段作業時に、形状記憶部材21を一定温度より昇温して初期記憶形状に戻すときの復元力を大ならしめ、この大きな復元力をそれ自体では復元力の小さな形状記憶樹脂22にも及ぼして形状記憶部材21の全体を迅速に初期記憶形状に戻し、型替えの迅速化を図ることができる。

【0049】（物品保持部材30、40）（図7（A）、（B））

図7（A）の物品保持部材30が前述の物品保持部材14と異なる点は、4個の形状記憶部材31A～31Dにより構成されたことにある。

【0050】図7（B）の物品保持部材40が前述の物品保持部材14と異なる点は、12個の形状記憶部材41A～41Lにより構成されたことにある。

【0051】（物品保持具50）（図8）

図8の物品保持具50が前述の物品保持具10と異なる点は、第1ベース部材11の上に第2ベース部材12を、第2ベース部材12の上に高さ調節用部材13を、高さ調節用部材13の上に物品保持部材14を結合し（ここまでは物品保持具10と同じ）、更に物品保持部材14の上に高さ調節用部材13を、高さ調節用部材13の上に物品保持部材14を結合したものである。これにより、物品保持具50は、高さ方向の2位置のそれぞれに物品保持部材14を設け、長尺の物品1を安定的に保持することができる。

【0052】尚、物品保持具50では、中間の物品保持部材14の上に高さ調節用部材13を結合可能とするため、物品保持部材14の上端面に位置するビス17Aに設けた孔51に位置決めピン52を設け、この物品保持部材14の位置決めピン52に高さ調節用部材13の下端面の位置決め孔13Aを係入可能としている。また、物品保持部材14の上端面に位置する固定リング17を磁石、金属等の磁性体からなるものとし、この固定リング17に高さ調節用部材13の薄板リング16を磁力により吸着せしめることとしている。

【0053】（物品保持具10の型替え方法及び装置）（図9、図10）

物品保持具10（物品保持具50も同じ）の型替え装置60は、図9に示す如く、物品保持部材供給装置61、加熱装置62、形状付与装置63、冷却装置64、高さ調節用部材供給装置65、物品保持部材セット装置66を有して構成される。

【0054】物品保持部材供給装置61は、ロボットからなり、物品保持具搬入ライン71を搬入されてくる物品保持具10の物品保持部材14を第1と第2のベース部材11、12から取出して物品保持部材成形ライン72のチャック72Aに移載し、この物品保持部材14を加熱装置62に供給する。

【0055】加熱装置62は、物品保持部材14の形状

記憶部材18を一定温度より昇温させてフラットな初期記憶形状に戻す。加熱装置62は、具体的には、赤外線ヒータ等にて構成できる。

【0056】形状付与装置63は、一定温度より昇温させた形状記憶部材18を物品モデルに衝合し得る物品保持形状に変形させる。形状付与装置63は、具体的には、図10に示す如く、形状記憶部材18を表裏から挟む上下一対の成形具63A、63Bにて構成できる。上成形具63A（雄型）の外面は、物品モデルの外形に一致し、下成形具63B（雌型）の内面は物品モデルの外形より形状記憶部材18の板厚分だけ拡大した相似形である。

【0057】冷却装置64は、形状付与装置63が付与した形状記憶部材18の上記物品保持形状を一定温度より降温させて固定化する。冷却装置64は、具体的には、形状付与装置63の成形具63A、63Bに内蔵される冷却媒体等にて構成できる。

【0058】高さ調節用部材供給装置65は、ロボットからなり、物品保持具搬入ライン71からバイパスライン73に搬入された第1と第2のベース部材11、12に高さ調節用部材13を結合する。

【0059】物品保持部材セット装置66は、ロボットからなり、物品保持部材成形ライン72において上述の加熱装置62、形状付与装置63、冷却装置64により新たな物品保持形状を付与された物品保持部材14を、バイパスライン73から排出されてくる第1と第2のベース部材11、12、高さ調節用部材13にセットして、新たな物品保持具10の組立を完了する。この物品保持具10は、物品保持具搬出ライン74により次工程へと搬出される。

【0060】従って、物品保持具10は、型替え装置60により以下の如くに型替えされる。

(1) 物品保持部材供給装置61により、第1と第2のベース部材11、12から物品保持部材14を取出し、この物品保持部材14を加熱装置62に供給する。

【0061】(2) 加熱装置62により、物品保持部材14の形状記憶部材18を一定温度より昇温させてフラットな初期記憶形状に戻す。

【0062】(3) 一定温度より昇温させた形状記憶部材18を、形状付与装置63により物品保持形状に変形させる。

【0063】(4) 冷却装置64により、形状記憶部材18の上記物品保持形状を一定温度より降温させて固定化する。

【0064】(5) 必要に応じ、高さ調節用部材供給装置65により、第1と第2のベース部材11、12に高さ調節用部材13を結合する。

【0065】(6) 物品保持部材セット装置66により、上記(4)の物品保持部材14を上記(5)の第1と第2のベース部材11、12、高さ調節用部材13にセットす

る。

【0066】尚、型替え装置60にあつては、物品保持部材供給装置61、加熱装置62、形状付与装置63、冷却装置64、高さ調節用部材供給装置65、物品保持部材セット装置66、物品保持具搬入ライン71、物品保持部材成形ライン72、バイパスライン73、物品保持具搬出ライン74の操作により、物品保持具10を構成する第1と第2のベース部材11、12、高さ調節用部材13、形状保持部材14のうちで、高さ調節用部材13の介装個数と介装位置、物品保持部材14の設置個数と設置位置を適宜変更し、複数個の高さ調節用部材13を介装させた長尺タイプ、複数個の物品保持部材14を適宜の高さ位置に設置された多段タイプ等を自在に組立できる。

【0067】従って、本実施形態によれば以下の如く的作用がある。

(物品保持具10について)

①物品保持部材14を構成する形状記憶部材18が各種の物品モデルに対応する物品保持形状に多様に変形でき、この物品保持形状を固定化できる。即ち、物品保持部材14を形状記憶部材18により構成するだけの簡易な構成により、多様な物品保持領域19を形成でき、各種形状の物品を安定的に保持できる。

【0068】このとき、形状記憶部材18としては、形状記憶樹脂と形状記憶合金とを用いることができる。両者はともに、一定温度より昇温することにより初期記憶形状（例えばフラット）に戻り、且つ物品モデルに衝合し得る物品保持形状に自由に変形できる。そして、両者は、一定温度より低温の使用温度域に降温すると、上記物品保持形状を固定化して物品保持領域19を形成する。

【0069】②上記①において、使用温度域で物品保持形状を固定化された形状記憶部材18の弾性率は、形状記憶合金より形状記憶樹脂の方が高い。従って、形状記憶部材18として形状記憶樹脂を用いる場合には、使用温度域での弾性率が高く、硬くなり、強い物品保持力を得て保持性能を向上できる。

【0070】③上記①において、新たな物品保持形状付与（型替え）のための前段作業として、形状記憶部材21を一定温度より昇温して初期記憶形状に戻すときの復元力は、形状記憶樹脂22より形状記憶合金23の方が大きい。従って、形状記憶部材21を形状記憶樹脂22と形状記憶合金23との複合体とすることにより、形状記憶部材21の型替え時に迅速に初期記憶形状に戻し、型替えの迅速を図ることができる。

【0071】④物品保持部材14を構成する複数個の形状記憶部材18を、物品保持領域19の回りに放射状に配置したから、物品の全周を複数個の形状記憶部材18のそれぞれによって安定的に保持できる。

【0072】⑤形状記憶部材18の物品保持領域19に

臨む平板矩形状部18Bをなすことにより、形状記憶部材18は物品に平板状の面(点や線でなく)で接するものとなり、物品を安定的に保持できる。

【0073】⑥ベース部材11、12と物品保持部材14との間に高さ調節用部材13を介装することにより、物品保持部材14が物品に接する物品保持高さ位置を、物品の高さ等の形状に応じて物品をより安定的に保持できる位置に選定でき、物品を安定的に保持できる。

【0074】(物品保持具10の型替え方法及び装置について)

①物品保持部材14を構成する形状記憶部材18に加熱工程と形状付与工程と冷却工程とを施すことにより、この形状記憶部材18に新たな物品保持形状を付与してこれを固定化すること(型替え)ができる。即ち、型替え作業は、物品保持部材14を他の部材と交換することなく、形状記憶部材18の形状変更を行なうのみで良く、簡易であり、自動化も容易となる。

【0075】②物品保持部材14を構成する形状記憶部材18に上記①の加熱工程を施す前にベース部材11、12から物品保持部材14を取り出し、上記①の冷却工程の後で物品保持部材14をベース部材にセットすることにより、形状記憶部材18に対する加熱、形状付与、冷却の各作業を容易に、効率良く行なうことができる。即ち、物品保持部材14はベース部材から切離されることにより独立化され、加熱工程、冷却工程での熱容量が小さくなり、加熱効率、冷却効率を向上できる。また、形状記憶部材18はベース部材の存在により下方を遮られること等がなくなり、形状記憶部材18の表裏から容易に成形具を作用させることができ、形状付与の作業性を向上できる。

【0076】③形状付与装置63が、形状記憶部材18を表裏から挟む一対の成形具63A、63Bからなるものとする事により、形状記憶部材18に確実且つ迅速に物品保持形状を付与できる。

【0077】(第2実施形態)(図11~図13)

(物品保持具80)(図11、図12)

物品保持具80は、矩形状ベース部材81に支柱82を介して六角形状枠材83を支持し、物品保持部材84を構成する6個の形状記憶部材85を枠材83の各辺のそれぞれに吊り下げ支持してなるものである。

【0078】形状記憶部材85は、第1実施形態の形状記憶部材18と同様の形状記憶樹脂にて構成される。従って、形状記憶部材85は、(a)一定温度(ガラス転移温度 T_g)より高温で初期記憶形状(例えば平板)に戻り、且つ物品モデルに衝合し得る物品保持形状に自由に変形できる。そして、(b)一定温度(ガラス転移温度 T_g)より低温の使用温度域(常温)で、上記物品保持形状を固定化して物品保持領域86を形成する。

【0079】(物品保持具80の型替え方法及び装置)(図13)

物品保持具80の型替え装置90は、第1実施形態の型替え装置60と同様に加熱装置、形状付与装置、冷却装置を有して構成され、形状付与装置91としてバルーン(例えば、株式会社ブリジストン製の「エアーピッカー」)91Aを用いている。即ち、形状付与装置91は、全形状記憶部材85の内側に物品モデル1Aを挿入し、各形状記憶部材85の外側に設けたバルーン91Aを加圧してふくらませ、それらのバルーン91Aと物品モデル1Aとの間の形状記憶部材85を物品保持形状に変形させるものである。

【0080】従って、物品保持具80は、型替え装置90により以下の如くに型替えされる。

(1) 加熱装置(図示せず)により、物品保持部材84の形状記憶部材85を一定温度より昇温させてフラットな初期記憶形状に戻す(図11)。

【0081】(2) 一定温度より昇温させた形状記憶部材85を、形状付与装置91により物品保持形状に変形させる。このとき、形状付与装置91のバルーン91Aを加圧してふくらませる(図13(A))。

【0082】(3) 冷却装置(図示せず)により、形状記憶部材85の上記物品保持形状を一定温度より降温させて固定化する。その後、形状付与装置91のバルーン91Aを排気して縮める(図13(B))。

【0083】(第3実施形態)(図14、図15)
(物品保持具100)(図14、図15)

物品保持具100は、円形箱状のベース部材101に物品保持部材102を設けたものである。そして、物品保持部材102を10本の短冊湾曲状の形状記憶部材103により構成している。形状記憶部材103の上端部はベース部材101の上端面に固定され、形状記憶部材103の下端部はベース部材101の側壁に設けたガイド孔104を貫通して外側に延出されている。

【0084】形状記憶部材103は、第1実施形態の形状記憶部材21の形状記憶合金23と同様の形状記憶合金にて構成される。従って、形状記憶部材103は、(a)一定温度(形状回復温度 A_f)より高温で初期記憶形状(相対する形状記憶部材103、103の間隔が保持対象物品径よりも小さくなる形態)(図14)に戻り、且つ物品モデルに衝合し得る物品保持形状に自由に変形できる。そして、(b)一定温度(形状回復温度 A_f)より低温の使用温度域(常温)で、上記物品保持形状を固定化して物品保持領域105を形成する(図15)。

【0085】また、物品保持具100の型替え方法及び装置は、第1実施形態の物品保持具10におけると同様にして以下の如くに行なうことができる。

(1) 物品保持部材102の相対する形状記憶部材103、103の間隔を物品モデル1Aよりも大きく開かせておき、この形状記憶部材103、103の中に物品モデル1Aを挿入する。

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【0086】(2) 加熱装置により、物品保持部材102の形状記憶部材103を一定温度より昇温させて初期記憶形状(図14)の側に戻す。この過程で、各形状記憶部材103が物品モデル1Aに適合して、形状記憶部材103に物品保持形状を付与できる。

【0087】(3) 冷却装置により、形状記憶部材103の上記物品保持形状を一定温度より降温させて固定化する。

【0088】(第4実施形態)(図16、図17)
(物品保持具110)(図16)

物品保持具110は、物品保持具10と基本的構成を同一としている。物品保持具110が物品保持具10と異なる点は、物品保持部材14を構成する形状記憶部材18の初期記憶形状として(平板状でなく)、各種物品形状のうち使用頻度の高い第1の物品保持形状Aを記憶せしめられたものである。

【0089】ここで、形状記憶部材18の初期記憶形状(第1の物品保持形状A)は、(1)形状記憶樹脂(もしくは形状記憶合金)を溶融させた状態から所望の第1の物品保持形状Aに成形固化する、或いは(2)形状記憶樹脂(もしくは形状記憶合金)の成形素材(例えば平板)を融点近傍まで昇温させた状態で所望の第1の物品保持形状Aに成形固化することにて付与される。

【0090】例えば、三菱重工業株式会社製の形状記憶ポリマー「ダイアリィ」を素材とする形状記憶部材18にあつては、融点近傍の130℃、15分の昇温状態で第1の物品保持形状Aを成形され得る。

【0091】従つて、物品保持具110の形状記憶部材18は、下記(A)の第1の物品保持領域19Aと下記(B)の第2の物品保持領域19Bを構成する。

(A) 第1の物品保持領域19A

形状記憶部材18は、(a) 使用温度域(常温)で如何なる形状を呈していても、一定温度(ガラス転移温度 T_g)より高温に昇温されて初期記憶形状である第1の物品保持形状Aに戻る。そして、(b) この形状記憶部材18をそのまま一定温度(ガラス転移温度 T_g)より低温の使用温度域(常温)に降温させれば、この第1の物品保持形状Aを固定化された第1の物品保持領域19Aを形成できる。

【0092】尚、物品保持具110において、形状記憶部材18の第1の物品保持形状Aは特定唯一の形状に永久固定のものであつても良く、或いは後述する型替え装置120による如くに設定替えされるものであつても良い。

【0093】(B) 第2の物品保持領域19B

形状記憶部材18は、(a) 一定温度(ガラス転移温度 T_g)より高温で初期記憶形状である第1の物品保持形状Aに戻り、且つこの第1の物品保持形状Aから物品モデルに適合し得る第2の物品保持形状Bに自由に変形できる。そして、(b) 一定温度(ガラス転移温度 T_g)より

低温の使用温度域(常温)で、第2の物品保持形状Bを固定化されて第2の物品保持領域19Bを形成する。

【0094】例えば、三菱重工業株式会社製の形状記憶ポリマー「ダイアリィ」を素材とする形状記憶部材18にあつては、ガラス転移温度 T_g をその素材種類により30~100℃程度としており、第1の物品保持形状Aを例えば80℃、1分の昇温状態で第2の物品保持形状Bに変形し得る。

【0095】図16は、形状記憶部材18に記憶せしめた第1の物品保持形状Aにより使用頻度の高い大直径の物品1を保持可能とする第1の物品保持領域19Aを形成し、形状記憶部材18に付与せしめた第2の物品保持形状Bにより小直径の物品1を保持可能とする第2の物品保持領域19Bを形成したものである。

【0096】(物品保持具110の型替え方法及び装置)(図17)

物品保持具110の型替え装置120は、物品保持具110を構成する物品保持部材14の形状記憶部材18に付与する第2の物品保持形状Bを多様に変形させることを主たる機能とし、物品保持具110のための型替え装置60と同様の物品保持部材供給装置61、加熱装置62、形状付与装置63、冷却装置64、高さ調節用部材供給装置65、物品保持部材セット装置66を具備する。また、型替え装置120は、形状記憶部材18に付与する初期記憶形状としての第1の物品保持形状A自体を付与もしくは設定替え可能としており、初期記憶形状設定ラインイン75を備え、この初期記憶形状設定ライン75に、初期加熱装置67、初期形状付与装置68、冷却装置69を具備する。

【0097】従つて、物品保持具110は、型替え装置120により、下記(A)の初期設定動作と、下記(B)の型替え動作とを行なう。

(A) 初期設定動作

(1) 物品保持部材供給装置61により、第1と第2のベース部材11、12から物品保持部材14を取り出し、この物品保持部材14を初期加熱装置67に供給する。

【0098】(2) 初期加熱装置67により、物品保持部材14の形状記憶部材18を融点近傍まで昇温させる。

【0099】(3) 融点近傍まで昇温させた形状記憶部材18に、初期形状付与装置68により、第1の物品保持形状Aを施す。

【0100】(4) 冷却装置69により、形状記憶部材18を降温させてその第1の物品保持形状Aを初期記憶形状として固定化する。

【0101】(5) 必要に応じ、高さ調節用部材供給装置65により、第1と第2のベース部材11、12に高さ調節用部材13を結合する。

【0102】(6) 物品保持部材セット装置66により、上記(4)の物品保持部材14を上記(5)の第1と第2のベース部材11、12、高さ調節用部材13にセット

し、初期記憶形状としての第1の物品保持形状Aを付与された物品保持具110の設定を完了する。

【0103】(B) 型替え動作

(1) 物品保持部材供給装置61により、第1と第2のベース部材11、12から物品保持部材14を取出し、この物品保持部材14を加熱装置62に供給する。

【0104】(2) 加熱装置62により、物品保持部材14の形状記憶部材18を一定温度より昇温させて初期記憶形状(第1の物品保持形状A)に戻す。

【0105】(3) 一定温度より昇温させた形状記憶部材18に、形状付与装置63により第2の物品保持形状Bを施す。

【0106】(4) 冷却装置64により、形状記憶部材18を降温させてその第2の物品保持形状Bを固定化する。

【0107】(5) 必要に応じ、高さ調節用部材供給装置65により、第1と第2のベース部材11、12に高さ調節用部材13を結合する。

【0108】(6) 物品保持部材セット装置66により、上記(4)の物品保持部材14を上記(5)の第1と第2のベース部材11、12、高さ調節用部材13にセットし、第2の物品保持形状Bを付与された物品保持具110の設定替えを完了する。

【0109】従って、本実施形態によれば、以下の如く的作用がある。物品保持部材14を構成する形状記憶部材18が第1の物品保持形状Aを初期記憶形状として付与されるとともに、各種の所望の物品形状に対応する第2の物品保持形状Bに多様に変形でき、この第2の物品保持形状Bを固定化できる。即ち、物品保持部材14を形状記憶部材18により構成するだけの簡易な構成により、初期記憶形状としての第1の物品保持形状Aと、これを多様に変形した第2の物品保持形状Bとを形成でき、各種形状の物品を安定的に保持できる。

【0110】そして、物品保持部材14の第1の物品保持形状Aを初期記憶形状として付与するから、一定温度(ガラス転移温度 T_g)より高温で初期記憶形状である第1の物品保持形状Aに戻り、これをそのまま一定温度(ガラス転移温度 T_g)より低温の使用温度域(常温)に降温させれば、この第1の物品保持形状Aを固定化された第1の物品保持領域Aを形成できる。従って、物品保持部材により保持される各種物品のうちで使用頻度の高い物品形状を第1の物品保持形状Aとして初期記憶せしめておけば、一旦他の物品保持形状(第2の物品保持形状B)を付与された物品保持部材を単に一定温度以上に昇温させるだけで上述の第1の物品保持形状Aを得ることができ、物品保持部材14の型替え頻度を低減できる。

【0111】このとき、形状記憶部材18としては、形状記憶樹脂と形状記憶合金とを用いることができる。両者はともに、一定温度より昇温することにより初期記憶

形状(第1の物品保持形状A)に戻り、且つ所望により選択された物品モデルに適合し得る他の物品保持形状(第2の物品保持形状B)に自由に変形できる。そして、両者は、一定温度より低温の使用温度域に降温することにより、上記物品保持形状(第1と第2の物品保持形状A、B)を固定化されて物品保持領域(第1と第2の物品保持領域19A、19B)を形成する。

【0112】以上、本発明の実施の形態を図面により詳述したが、本発明の具体的な構成はこの実施の形態に限られるものではなく、本発明の要旨を逸脱しない範囲の設計の変更等があっても本発明に含まれる。例えば、ベース部材は物品保持具に必須ではなく、物品保持部材にベース部材の機能を兼ね備えた構成にしてもよく、また、本発明の物品保持部材を構成する形状記憶部材として用いられる形状記憶樹脂は、樹脂の吸湿による膨潤を避けるため、表面に撥水処理を施して用いることが好ましい。

【0113】尚、物品保持具10(50等も同じ)にあつては、ベース部材12に高さ調節用部材13を保持し、高さ調節用部材13に物品保持部材14を保持するため、(a) ベース部材12の上端面に設けた位置決めピン12Dを高さ調節用部材13の下端面の位置決め孔13Aに係入するとともに、ベース部材12の上端面の吸着用薄板リング15に高さ調節用部材13の下端面の吸着用薄板リング16を磁着保持するとともに、(b) 高さ調節用部材13の上端面に設けた位置決めピン13Bを物品保持部材14の下端面の位置決め孔14Aに係入するとともに、高さ調節用部材13の上端面の吸着用薄板リング15に物品保持部材14の下端面の吸着用薄板リング16を磁着保持するものとした。但し、ベース部材12に高さ調節用部材13を保持し、高さ調節用部材13に物品保持部材14を保持する他の手法として、図18に示す如く、(a) ベース部材12の上端面に設けた小径リング状部201に高さ調節用部材13の下端面の大径リング状部202を嵌合するとともに、ベース部材12の小径リング状部201の外周部に設けた係合凹部203に高さ調節用部材13の大径リング状部202の内周部に埋め込んだ弾発ブランジャ204を係合することにてベース部材12に高さ調節用部材13を保持し、(b) 高さ調節用部材13の上端面に設けた小径リング状部211に物品保持部材14の下端面の大径リング状部212を嵌合するとともに、高さ調節用部材13の小径リング状部211の外周部に設けた係合凹部213に物品保持部材14の大径リング状部212の内周部に埋め込んだ弾発ブランジャ214を係合することにて高さ調節用部材13に物品保持部材14を保持するものとしてもよい。ここで、弾発ブランジャ204(214も同じ)は、高さ調節用部材13、物品保持部材14に埋め込まれるケース204Aに圧縮ばね204Bとボール204Cを格納し、ボール204Cがケース204Aから

飛び出さないようにボール204Cの赤道部をケース204Aの開口部にて係止する状態で、圧縮ばね204Bによりボール204Cを外方に向けて弾発するものである。

【0114】

【発明の効果】以上のように本発明によれば、簡易な構成により、各種形状の物品を安定的に保持することができる。

【図面の簡単な説明】

【図1】図1は第1実施形態の物品保持具を示す模式図である。

【図2】図2は物品保持部材を示す模式図である。

【図3】図3は物品保持部材の他の例を示す模式図である。

【図4】図4は物品保持状態を示す模式図である。

【図5】図5は物品保持具を示す斜視図である。

【図6】図6は物品保持具の分解状態を示す斜視図である。

【図7】図7は物品保持部材の変形例を示す模式図である。

【図8】図8は物品保持具の変形例を示す模式図である。

【図9】図9は物品保持具の型替えラインを示す模式図である。

【図10】図10は形状付与装置を示す模式図である。

【図11】図11は第2実施形態の物品保持具を示す模

式図である。

【図12】図12は物品保持状態を示す模式図である。

【図13】図13は形状付与装置を示す模式図である。

【図14】図14は第3実施形態の物品保持具を示す模式図である。

【図15】図15は物品保持状態を示す模式図である。

【図16】図16は第4実施形態の物品保持具を示す模式図である。

【図17】図17は物品保持具の型替えラインを示す模式図である。

【図18】図18は物品保持具の変形例を示す模式図である。

【符号の説明】

1 物品

1A 物品モデル

10、110 物品保持具

11、12 ベース部材

13 高さ調節用部材

14、20 物品保持部材

18、21 形状記憶部材

18B 平板矩形形状部

19 物品保持領域

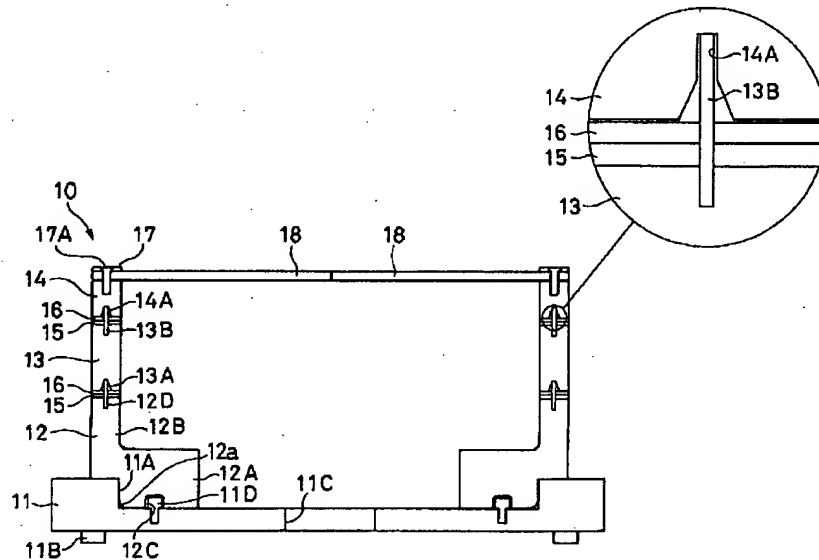
19A 第1の物品保持領域

19B 第2の物品保持領域

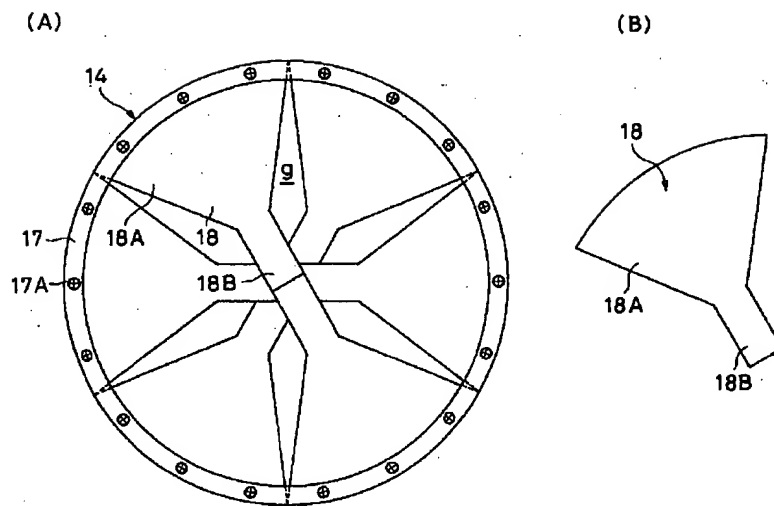
22 形状記憶樹脂

23 形状記憶合金

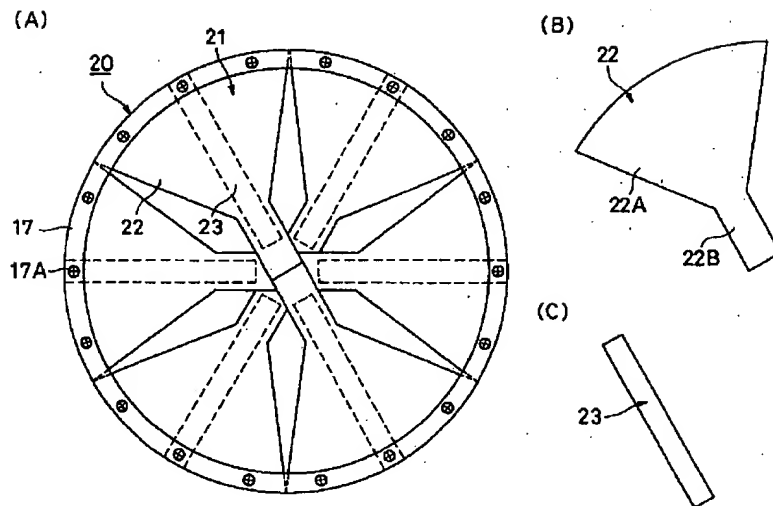
【図1】



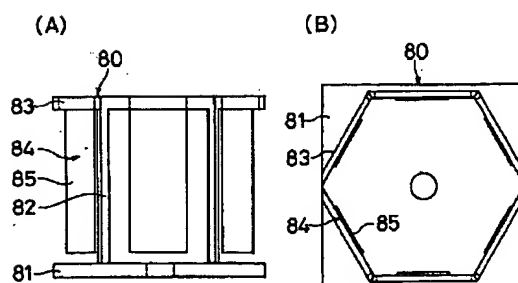
【図2】



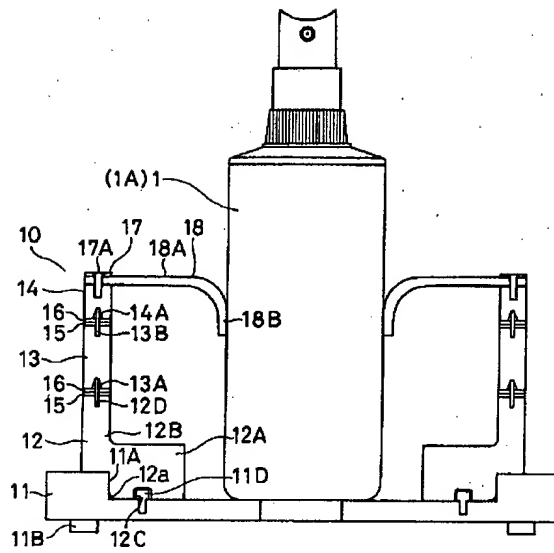
【図3】



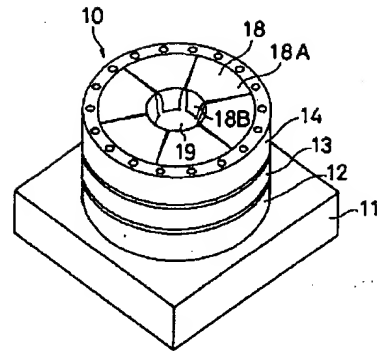
【図11】



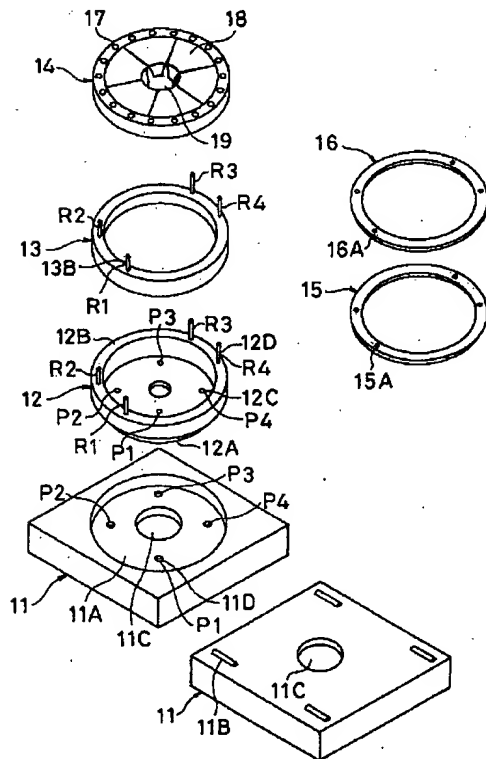
【図4】



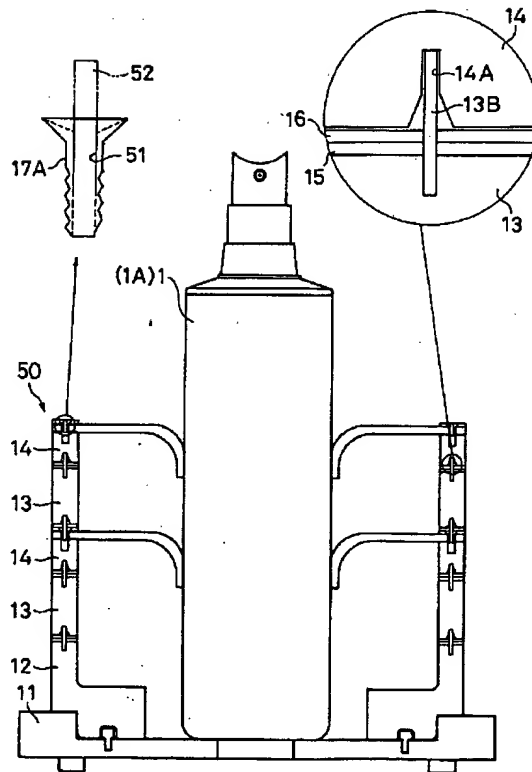
【図5】



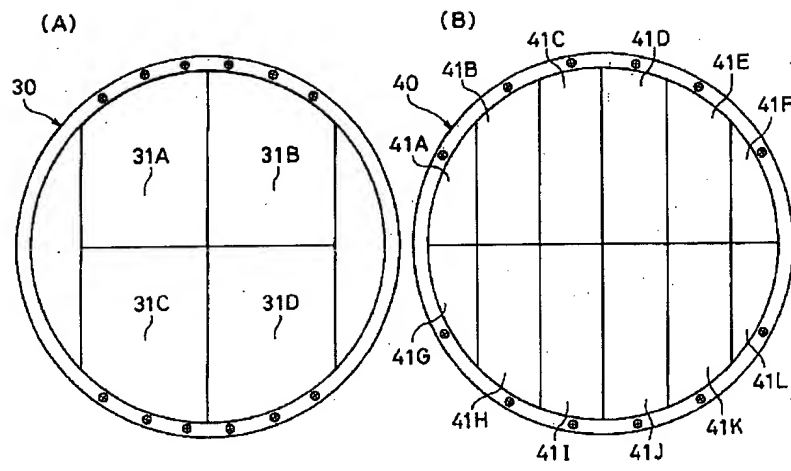
【図6】



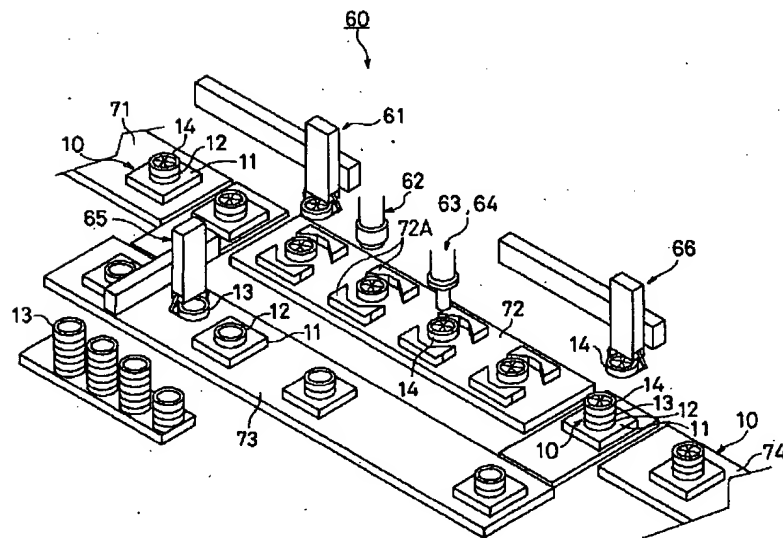
【図8】



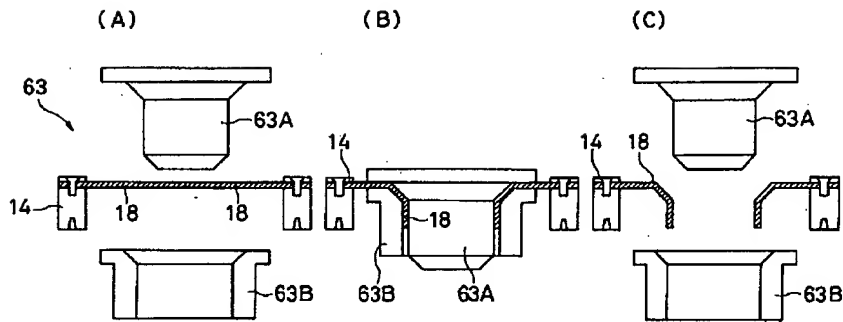
【図7】



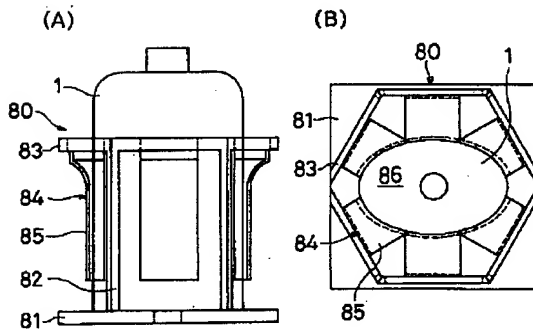
【図9】



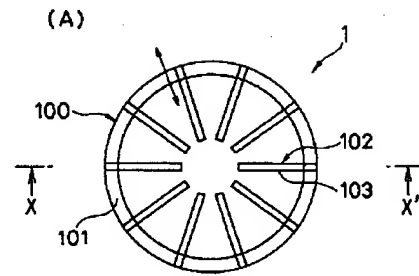
【図10】



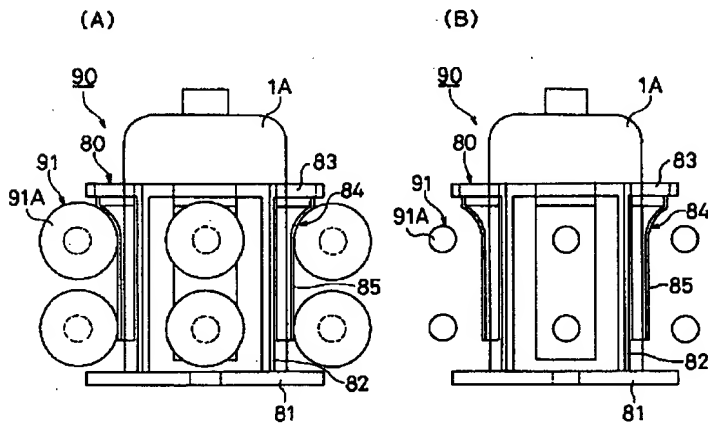
【図12】



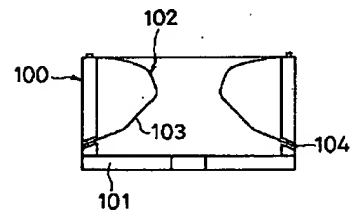
【図14】



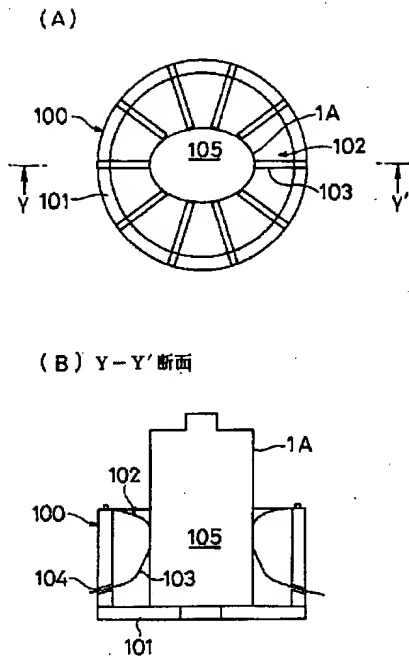
【図13】



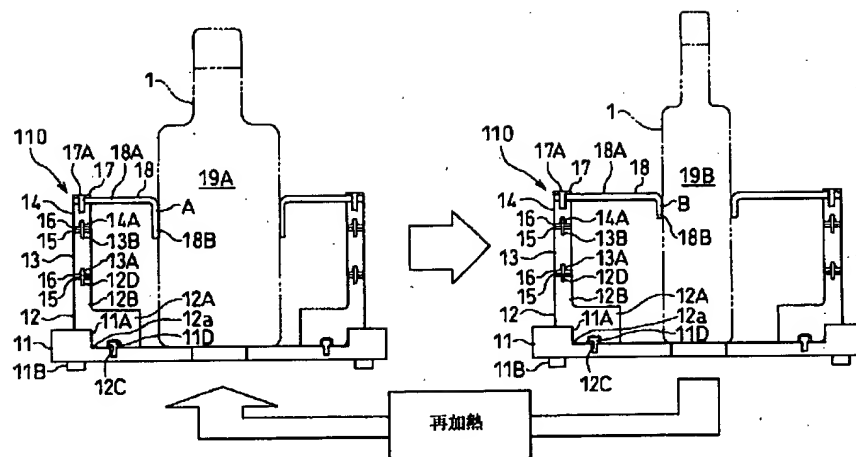
(B) X-X' 断面



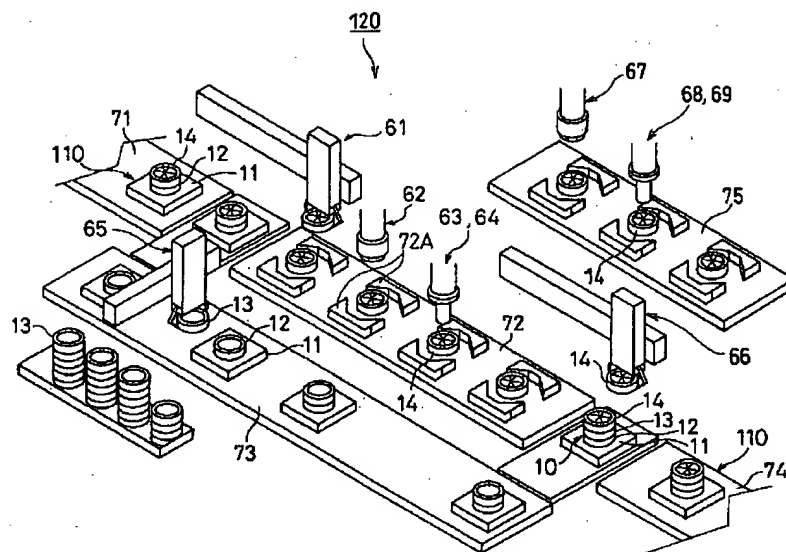
【図15】



【図16】



【図17】



【図18】

